ESTONIAN UNIVERSITY OF LIFE SCIENCES
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VETERINARIANS APPROACH TO FELINE LOWER URINARY TRACT DISEASE

KASSIDE ALUMISTE KUSETEEDE HAIGUSTE KÄSITLEMINE LOOMAARSTIDE POOLT

Final Thesis
Curriculum in Veterinary Medicine

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Tartu 2021

Estonian University of Life Sciences
Kreutzwaldi 1, 51014, Tartu Estonia

Abstract of Final Thesis

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Curriculum: Veterinary Medicine

Title: Veterinarians approach to feline lower urinary tract disease

Pages: 81	Figures: 2	Tables: 9	Appendixes: 3

Chair: Chair of Clinical Veterinary Medicine

Field of research and (CERC S) code: 3. Health, 3.2. Veterinary Medicine

B750 Veterinary medicine, surgery, physiology, pathology, clinical studies

Supervisors: Kristel Peetsalu, Toomas Orro

Place and year: Tartu 2021

In feline medicine, feline lower urinary tract disease (FLUTD) is one of the most commonly encountered syndrome. Aims of this study were to investigate how veterinarians in Finland and Estonia approach FLUTD, whether there are any differences between these two countries, and whether there are any differences between diagnoses, treatments or treatment recommendations with veterinarians working in specialized vs. non-specialized clinics. A questionnaire regarding FLUTD anamnesis, diagnostics, treatment and feline idiopathic cystitis (FIC) was sent out to veterinarians in Finland and Estonia. 76 veterinarians completed the survey. There are several causes for FLUTD, but most commonly FIC, urethral obstruction (UO) and urolithiasis were seen in veterinary clinics. Most common clinical signs include hematuria, periuria, pollakiuria and stranguria.

Veterinarians in Finland and Estonia described and diagnosed the disease in similar manner but there were certain differences in treatments and treatment recommendations. Antibiotics were more commonly prescribed in Estonia ($p = 0.001$). Veterinarians working in specialized clinics diagnosed neurological disorders ($p = 0.033$), and recommended acupuncture ($p = 0.051$) more often than veterinarians working in non-specialized clinics. Veterinarians working in Finland diagnosed less neurological disorders ($p = 0.003$) and recommended more often anxiety relieving supplements ($p = 0.041$) than veterinarians working in Estonia.

Keywords: FLUTD, feline, veterinarians, approach, Finland, Estonia

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Eesti Maaülikool Kreutzwaldi 1, 51014, Tartu		Lõputöö lühikokkuvõte	
Autor: Mervi Irene Sulin		Õppekava: Veterinaarmeditsiin	
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Lehekülgi: 81	Jooniseid: 2	Tabeleid: 9	Lisasid: 3
Õppetool: Kliinilise veterinaarmeditsiini õppetool ETIS-e teadusvaldkond ja CERC S-i kood: 3. Terviseuuringud, 3.2 veterinaarmeditsiin B750 Veterinaarmeditsiin, kirurgia, füsioloogia, patoloogia, kliinilised uuringud Juhendajad: Kristel Peetsalu, Toomas Orro Kaitsmiskoht ja -aasta: Tartu 2021			
Kasside alumiste kuseteede haigused on veterinaarias sage leid. Uuringu eesmärk oli teada saada, kuidas loomaarstid Soomes ja Eestis käsitlevad kasside alumiste kuseteede haigusi, ning kas spetsialiseerunud ja tavaloomakliinikutes on erinevusi diagnoosimises ja ravisoovitustes. Eestis ja Soomes viidi läbi küsitlus, mis hõlmas küsimusi kasside alumiste kuseteede haiguste, sh idiopaatilise tsüstiidi anamneesi, diagnoosimise ja ravi kohta. Küsimustikule vastas 76 loomaarsti. Kasside alumiste kuseteede haigustel on erinevad põhjused, enim esinevad kasside idiopaatiline tsüstiit, ureetra obstruktsioon ja urolitiaas. Sagedasemad sümptomid on hematuuria, periuuria, pollakuuria ja stranguuria. Kasside alumiste kuseteede käsitlemine oli mõlemas riigis sarnane, erinevusi oli vähe, neid esines peamiselt ravi osas. Antibiootikumiravi määrati rohkem Eestis ($p = 0,001$). Erinevusi täheldati eri tüüpi kliinikute vahel, kusjuures spetsialiseerunud loomakliinikutes diagnoositi rohkem neuroloogilisi häireid ($p = 0,033$). Samuti soovitasid spetsialiseerunud loomakliinikute loomaarstid rohkem nõelravi ($p = 0,051$). Loomaarstid, kes töötasid Soome kliinikutes, diagnoosisid vähem neuroloogilisi probleeme ($p = 0,003$) ja soovitasid anksiolüütilisi preparaate sagedamini ($p = 0,041$) kui Eesti sama tüüpi kliiniku loomaarstid.			
Märksõnad: Kasside alumiste kuseteede haigused, kass, loomaarstid, lähenemine, Soome, Eesti			

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ABBREVIATIONS

AAHA	American Animal Hospital Association
ACVIM	American College of Veterinary Internal Medicine
BCS	Body condition score
BW	Body weight
CaOx	Calcium oxalate
CKD	Chronic kidney disease
COX	Cyclooxygenase
DIC	Disseminated intravascular coagulation
DM	Diabetes mellitus
E. coli	*Escherichia coli*
EMA	European Medicines Agency
ESCAV	European Surveillance of Veterinary Antimicrobial Consumption
EST	Estonia
FeLV	Feline leukemia virus
FIC	Feline idiopathic cystitis
FIN	Finland
FLUTD	Feline lower urinary tract disease
FUS	Feline urologic syndrome
GABA	Gamma-aminobutyric acid
GAG	Glycosaminoglycan
HD	Hepatic disease
HT	Hyperthyroidism
IC	Idiopathic cystitis/interstitial cystitis
IMHA	Immune-mediated hemolytic anemia
ISCAID	International Society for Companion Animal Infectious Diseases
LP	Lamina propria
LUTS	Lower urinary tract signs
MEMO	Multimodal environmental modification
NaCl	Sodium chloride

NAG	N-acetyl-β-D- glucosaminidase
NSAID	Nonsteroidal anti-inflammatory drug
PAC	Proanthocyanidin
SAA	Serum amyloid A
SBU	Subclinical bacteriuria
SRS	Stress response system
TCC	Transitional cell carcinoma
TM	Tamm-Horsfall
UI	Urinary incontinence
UO	Urethral obstruction
UPC	Urine protein creatinine ratio
USG	Urine specific gravity
USMI	Urethal sphincter mechanism incompetence
UTI	Urinary tract infection

INTRODUCTION

Feline lower urinary tract disease (FLUTD) is a collective term for many diseases that include feline idiopathic cystitis (FIC), urolithiasis, urinary tract infection (UTI) and neoplasia among others. FIC seems to be the most common cause for FLUTD. FLUTD has been described as early as 1925 and remains one of the most common problems encountered in feline medicine (Little, 2012). Clinical signs are variable and not specific to any of the FLUTD conditions, which makes it impossible to define an exact cause without thorough examinations. Clinical signs associated with FLUTD include haematuria, pollakiuria, periuria, over-grooming and behavioral changes (Gunn-Moore, 2003).

Owners often notice the more obvious signs such as the cat vocalizing when urinating. Diagnostics methods for FLUTD include thorough anamnesis, blood samples, complete urinalysis and diagnostic imaging. Treatment protocols are different for different FLUTD conditions but include medications as well as surgical approach in some cases. FLUTD can be a challenging condition to treat and tend to reoccur. Owner's full compliance to treatments is required as FLUTD could also presumably lead to surrending of cats to rescue shelters. House-soiling is seen as one of the more problematic behaviours affecting the owner's life and is one of the common behavioral reason for relinquishment (Casey et al., 2009).

The aims of this study were to investigate how veterinarians in Finland and Estonia approach FLUTD and to compare how they diagnose and treat the syndrome, and what kind possible differences there are with these two countries.

1. LITERATURE REVIEW

1.1. Feline lower urinary tract disease

The term FLUTD or lower urinary tract signs (LUTS) are collective terms and describe different kind of conditions that affect the lower urinary tract of cats (Gunn-Moore, 2003; Kim et al., 2018). These diseases include bacterial cystitis, tumors, urolithiasis and neurogenic disease among others. In majority of the cases, the exact cause of FLUTD is not identified. In this case the term idiopathic cystitis (IC) is used (Lew-Kojrys et al., 2017; Kim et al., 2018). Table 1 lists some causes of FLUTD percentage-wise. Altogether some 30 different causes of FLUTD have been described (Buffington et al., 2014).

Table 1. Causes of feline lower urinary tract disease (FLUTD). Source Kaul et al. (2020)

Diagnosis	% from all FLUTD diagnoses
Feline idiopathic cystitis (FIC)	55-69
Urolithiasis	12-22
Urinary tract infection (UTI)	1.5-20
Neoplasia (bladder wall)	0.3-3.6
Neurological disoders	0.2-3.0

FLUTD is a common occurrence in veterinary clinics. Majority of current data collected on cats with LUTS are from veterinary clinics. It is likely that not all the cats displaying LUT signs are presented to a veterinary clinics due to the owners not necessarily recognizing the more subtle signs or only bringing the cats in when the signs become unacceptable (such as urinating outside the litter box). Therefore, the prevalence of LUTS is likely to be higher than what is currently reported (Longstaff et al., 2017).

Signs of lower urinary tract disease have been described in veterinary medicine for almost hundred years (Buffington et al., 2014). Jarvis described feline urinary calculi in 1958 writing about the possible relation with diet and the formation of urinary calculi. In 1970,

term feline urologic syndrome (FUS) by Osbaldiston and Taussig was suggested to describe *"the feline disease syndrome characterized by dysuria, urethral obstruction, urolithiasis and hematuria"*. This term was replaced in 1984 when Osborne and colleagues suggested that the term FUS would be substituted with descriptive terms pertaining to the site, cause, morphologic changes and pathophysiology of the disease (Buffington et al., 2014). Buffington et al. coined the terms 'feline interstitial cystitis' and 'feline idiopathic cystitis' in 1999 after their investigations of cats with severe chronic idiopathic LUTS. They proposed the term FIC to*"describe cats with chronic irritative voiding signs that had sterile and cytologically negative urine in which cystoscopy was not performed, but in which other appropriate diagnostic procedures, such as imaging of the lower urinary tract, did not identify a cause."* (Buffington et al., 2014).

The risk factors for FLUTD are different based on the seasons, diets and the cat's lifestyle (Piyarungsri et al., 2020). FLUTD can present itself in cats of any age and sex but it is frequently seen in neutered male cats that are middle-aged, overweight, have a restricted access to outside, live in multi-pet household and eat a dry-diet (Gunn-Moore, 2003). A study by Lund et al. (2013) on Norwegian cat population found that increased body weight (BW) was significantly associated with the increased odds of FLUTD and that age and reproductive status were less important. Dorsch et al. (2014) reported higher incidence of urethral obstruction (UO) in cats with higher BW and younger age in a German cat population. An Australian study by Jukes et al. (2019) reported an increased risk with UO in cats with higher body condition score (BCS) but not BW. Lew-Kojrys et al. (2017) reported that in Poland, FLUTD was most common in strictly indoor cats and the diet consisted mostly dry food. A study by Sumner & Rishniw (2017) suggests that UO is, at least partly, influenced by climatic variations in the Northern United States. Piyarungsri et al. (2020) reported that FLUTD was most commonly diagnosed in castrated male cats in Chiang Mai, Thailand. Kovarikova et al. (2020) reported, that the most common cause of FLUTD in Chech Republic is FIC in strictly indoors, male cats.

Different FLUTD conditions can occur individually or together with different kind of combinations. There can also be other medical conditions or environmental requirements that play a role with the different FLUTD diseases (Gunn-Moore, 2003; Buffington et al., 2014). Medical comorbities associated with FLUTD include diabetes mellitus (DM), chronic

kidney disease (CKD) and hyperthyroidism (HT) - these animals most often have UTI (Mayer-Roenne et al., 2007; White et al., 2016).

Cats with recurrent FLUTD can also be diagnosed with different FLUTD causes at separate episodes (Lund & Eggertsdóttir, 2019). Kaul et al. (2020) stated in their study that *"more than half of the cats with FLUTD presented with two or more recurrent episodes irrespective of the identified aetiology."* Most of the recurrent FLUTD episodes occur within the first year after the initial presentation but first recurrent episodes are possible also after two or three years. Cats with FLUTD should be investigated in depth with each presentation, as it cannot be assumed that the underlying cause is the same every time. Table 2 lists the recurrence rate of some of FLUTD conditions.

Table 2. Recurrence percentages of feline lower urinary tract disease (FLUTD). Source Kaul et al. (2020)

Diagnosis	**% of recurrence of most common FLUTD conditions**
Feline idiopathic cystitis (FIC)	17-65
Urolithiasis	5.5-38.5
Urinary tract infection (UTI)	14.7
Urinary obstruction (due to FIC)	17-58

Kaul et al. (2020) reported FLUTD recurrence rate of 58.1% and mortality of 5%, which differs from previously reported higher mortality rates (Defauw et al., 2011). The primary cause of death in FLUTD cats seems to be recurrent UO (Kaul et al., 2020). A recent study by Eggertsdóttir et al. (2021) reported a long-term prognosis for FIC, the most common cause of FLUTD, to be fairly good as around 70% of the cats included in their study recovered without additional episodes or experienced only few recurrences, and the cats were also alive after a minimum of 10 years.

1.1.1. Clinical signs

It is not possible to identify the cause of FLUTD only based on clinical signs (Little, 2012). LUTS in cats can include pollakiuria, stranguria, haematuria and periuria (Gunn-Moore, 2003; Little, 2012). One of the first signs of FLUTD is pollakiuria without polyuria (Lew-Kojrys et al., 2017). Some cats can have with bilateral ventral abdominal and inguinal

alopecia due to licking iniated by pain (Little, 2012). Many cases of non-obstructive FLUTD are self-limiting resolving usually within 5-10 days (Gunn-Moore, 2003).

FLUTD most often affects the bladder and urethra, although problems with the ureters (eg. ureteroliths) and kidneys (pyelonephritis due to ascending UTI) are also possible.

1.1.2. Species susceptibility

Cats are notoriously sensitive to their surroundings and they have a very well developed fight or flight response (Buffington, 2011b; Carney et al., 2012). Their responses to threat stimuli have been studied for decades. The term *fight or flight* originally resulted from studies done on cats during the first decades of the 20th century by physiologist Walter B. Cannon (Buffington, 2011b). In today's society, cats have been artificially selected for physical features but selection for function has not been similar to dogs. Modification of behavior has been more limited and the domestic cat still retains many of the behavioral traits of its wild ancestors. Cats are also not socially obligate mammals and this has significant implications for cats that are primarily living as companion animals. Creating an environment that fulfills cat's species-specific needs can therefore be challenging (Heath, 2020).

As mentioned before, there are many causes for FLUTD. Stress responses can activate LUTS but the exact neural mechanisms and pathways that link psychosocial stress to altered behaviors and physiolocigal diseases are still unclear (Buffington & Bain, 2020). Micturation in animals plays a much bigger role than it does in humans. Micturation does not take place only to empty the bladder but also in context of other survival mechanisms. Olfaction plays a big role in the survival of the individual and urine signals important messages of territory, estrous cycle and mating possibilities (Holstege, 2005).

Current evidence suggests that the urinary bladder is not always the only evil for FLUTD. Various different conditions have been identified in cats with recurring, severe FLUTD. In some cats, combination of genetic and environmental factors can lead to them having more sensitive and overactive sympathetic nervous system, increased hypothalamic-pituitary activity and alterations in immune and endocrine systems. This is thought to be associated with behavioral, intestinal, dermatologic and endocrine diseases, among others. These are often the most common comorbidities in feline medicine. The urinary bladder can be just

one of the organs that is affected by a systemic process due to sensitized central stress response system (SRS) (Buffington, 2011b; Buffington et al., 2014; Buffington & Bain, 2020).

1.2. Etiologies of feline lower urinary tract disease

1.2.1. Urolithiasis

Urolithiasis is a common urinary tract disorder in cats and dogs. Clinical signs include hematuria, pollakiuria and stranguria and can vary depending on the location of the urolith. Stones vary in their mineral composition but struvite (magnesium ammonium phosphate) and calcium oxalate (CaOx) forms are most commonly seen (Gunn-Moore, 2003; Houston et al., 2009; Labato, 2017; DiPartola & Westropp, 2020). No known specific risk factors have been identified for urolithiasis but there are likely intrinsic and extrinsic factors, such as age, breed and environment of the cat, that play a role. Cats with struvite uroliths are often younger than cats with CaOx-uroliths. Male cats appear to be more predisposed to CaOx-uroliths. Stress-related events in the cat's life and obesity can also possibly contribute to urolith formation (DiPartola & Westropp, 2020). When the uroliths become embedded in the urethra the clinical signs resemble UO (Labato, 2017). In case of urolithiasis there is a formation of calculi within the urinary tract.

Struvite, oxalate and amorphous phosphate crystals are also seen in the urine of healthy animals. Crystals form by precipitation of solutes, specifically inorganic salts, iatrogenic compounds or organic compounds (Labato, 2017).

1.2.1.1. Struvites

Struvite crystals form in alkaline urine. Alkaline urine is often in association with bacterial infection. In cats, however, struvites are most often seen with sterile urine. This is probably due to ammonia being excreted by the renal tubules. Struvites can also be seen in clinically healthy animals with alkaline urine (Alleman & Wamsley, 2017; Labato, 2017).

1.2.1.2. Calcium oxalates

CaOx are the most common urolith removed from cats and the most common location for oxalate stones is the bladder. There are likely predisposing extrinsic and intrinsic factors for forming CaOx, including age, breed and environment (DiPartola & Westropp, 2020). When the urine is supersaturated with oxalates and calcium the crystals are more likely to occur. Other factor affecting the crystal formation is the balance between the substances that promote and inhibit CaOx formation (Labato 2017). Diet can influence urine acidity and this influence the CaOx formation in some individuals (Westropp & Lulich, 2017).

1.2.2. Bacterial cystitis

The development of UTI is multifactorial, depending on the interaction between the virulence of an organism and alterations in environmental, anatomic and immunologic competency of the host. Commonly the microbes are uropathogenic bacteria that ascend from the distal urogenital tract into the proximal urethra and urinary bladder (Wood, 2017). Bacterial UTI is less common in cats than dogs. It´s estimated that 1-2% of cats suffer from UTI during their lifetime (Dorsch et al., 2019). Many young cats with LUTS have different disorders like FIC, which are not associated with bacterial infections. UTI's occurs together with comorbidities such as HT, CKD or DM and the prevalence of UTI increases with these comorbidities, athough these infections are not often associated with the clinical signs of UTI´s but are subclinical (Mayer-Roenne et al., 2007; White et al., 2016). The prevalence is the highest with cats with CKD, although only approximately one fifth of these cats display clinical signs of UTI. Other factors that can predispose cats to bacterial cystitis include female sex, older age and lower BW. UTI is an important cause of FLUTD in cats older than 10 years old, affecting some 40-45% of them (White et al., 2016; Dorsch et al., 2019; DiPartola & Westropp, 2020).

1.2.2.1. Subclinical bacteriuria

Subclinical bacteriuria (SBU) is diagnosed when there´s a significant number of bacteria in the urine sample obtained by cystocentesis, without the presence of the clinical signs associated with UTI. The term is also used when there´s evidence of inflammation in the urine sediment (Dorsch et al., 2019). It was previously suggested that cats with HT, DM or CKD were more prone to SBU. However, a recent study by Peterson et al. (2020) did not

report an increased risk of SBU in hyperthyroid cats and the prevalence of SBU was approximately the same as in the cohort euthyroid cats. Moberg et al. (2020) reported similar findings - there was no statistically significant increased risk associated with HT, DM or CKD. Hepatic disease (HD), however, was found to be a significant risk factor for SBU.

1.2.2.2. Classification of bacterial cystitis

Classification of bacterial cystitis in dogs and cats was recently reviewed and updated by The International Society for Companion Animal Infectious Diseases (ISCAID). Sporadic bacterial cystitis is a condition occasionally seen in cats. Bacterial infection of the bladder leads to an inflammation and clinical signs can include hematuria, stranguria and pollakiuria. Bacterial cystitis in cats has been often classified as complicated UTI due to the presence of comorbidities. There is no evidence that sporadic bacterial cystitis in cats would be more complicated to treat than in dogs. However, majority of young cats do not have true bacterial cystitis but urolithiasis or FIC (Weese et al. 2019).

Recurrent bacterial cystitis is diagnosed when there are three or more episodes of clinical bacterial cystitis in the previous 12 months or two or more episodes in the previous 6 months. Recurrent bacterial cystitis may be due to relapsing or persistent infection or reinfection (Weese et al. 2019). With relapsing infection, the infecting organism may be deep-seated in the tissues and be inaccessible to the antimicrobial (eg. kidney, prostate). Other reasons for relapsing infection can be subtherapeutic concentrations of the antimicrobial in the urinary tissues or antimicrobial resistance. Persistent infection is a variation of a relapsing infection, where bacterial cultures are positive with the same organism during antimicrobial treatment. The organism has not been fully eradicated even with administration of therapeutic levels of antimicrobials. Reinfection is identified when the bacterial culture of the urine reveals a different bacterial genus compared to the initial infection (DiPartola & Westropp, 2020).

1.2.3. Urethral plugs

Most of the urethral plugs consist of large quantities of mucus and inflammatory debris with different quantities of minerals (Houston et al., 2003). The matrix can also contain blood sloughed tissue and inflammatory cells (Bartges, 2017). Mucus and crystal plugs are usually found at the narrowing of the urethra at the tip of the penis (Houston et al., 2003). Many of the urethral plugs contain struvite crystals and a proteinaceous matrix (eg. albumin). The

exact cause of urethral plugs is currently unknown. With FIC, vasodilation and leakage of plasma proteins from the suburothelial capillary plexus and secondary urethritis can be seen and this can trap crystals and other debris within the urethral lumen of male cats and result to UO (DiPartola & Westropp, 2020). In neutered cats, there´s an increased density of collagen fibers and decreased density of the elastic fibers in the corpus spongiosum and these changes can be predispose a cat for urethral obstructive disease (Borges et al., 2017).

1.2.4. Neoplasia

Tumors of the urinary bladder are rare in cats but their prevalence appears to have increased in the last few decades. Most of the tumors of the bladder and urethra are epithelial and malignant. Intermediate to high-grade invasive transitional cell carcinoma (TCC) is the most common diagnosis in both dogs and cats with bladder neoplasia. In cats TCC is more rare than in dogs and it affects geriatric cats (Bommer et al., 2012; Borrego, 2017). According to a study conducted by Griffin et al. (2020), the location of TCC varies more in cats than in dogs but the trigone area of the bladder is the most common site. The cats with TCC are often presented to the clinic for lower urinary tract disease signs and this may delay the diagnosis for TCC. Prior lower urinary tract disease and inflammation can also predispose cats to TCC. Cats can also, in addition to carcinoma, have benign and malignant mesenchymal urinary bladder tumors. These tumors can include angioma, leiomyosarcoma and hemangiosarcoma. Also, lymphoma has been reported (Griffin et al., 2018).

1.2.5. Micturition disorders

Urinary incontinence (UI) is relatively rare in cats but has been associated with over 43 congenital or acquired disorders (Lonc et al., 2020). Most common causes of UI include neurologic disorders and congenital abnormalities. Micturition disorders are classified as neurogenic or non-neurogenic (Little, 2012). Sacral spinal cord level disorders cause neurogenic incontinence and anatomical and functional disorders cause non-neurogenic incontinence (Fischer & Lane, 2017). A recent study by Lonc et al. (2020) found that UI occurred with equal frequency between female and male cats. Similar frequency was found with voiding phase and storage phase disorders. Voiding phase disorders were more common in male cats and storage phase disorders more common in female cats.

1.2.5.1. Neurogenic disorders

There can be different neurological disorders that cause UI including intervertebral disk disease and spinal arachnoid cyst. Lesions of the cauda equine, sacral spinal cord and peripheral nerves can cause lower motor neuron dysfunction. In these cases the sensory and motor input to the bladder is lost. This type can be seen with spinal malformation with the Manx cat (Little, 2012; DiPartola & Westropp, 2020).

1.2.5.2. Non-neurogenic disorders

Non-neurogenic causes of UI are classified according to whether the bladder is distended. Bladder detrusor atony is a common non-neurogenic disease with a distended bladder. This disorder can be seen with prolonged UO (Little, 2012). A quite rare cause of detrusor atony is feline dysautonomia. Feline dysautonomia affects the autonomic nervous system and clinical signs include mydriatic pupils, megaesophagus, vomiting and incontinence or urinary retention. This disorder most commonly affects young domestic short hair cats (Barone, 2012).

Non-neurogenic causes of incontinence without a distended bladder include congenital defects. These include urethal sphincter mechanism incompetence (USMI), ectopic ureters and urethal hypoplasia among others. UI has also been reported in cats infected with feline leukemia virus (FeLV) (Little, 2012).

1.2.5.3. Urethal sphincter mechanism incompetence

USMI is a common cause for UI in neutered female dogs. There's a failure of the urethra to appropriately close during urine storage and this causes the leakage of urine. USMI in cats is uncommonly reported and most cases are considered congenital anomalies, related with other anatomical abnormalities such as urethral hypoplasia. Clinical signs are often severe (Berent & Mayhew, 2017). Cats who are suspected having USMI should also be tested for FeLV as an association with these two diseases has been suggested (DiPartola & Westropp, 2020).

1.2.5.4. Ectopic ureters

Ectopic ureters cause UI. Ectopic ureters are rare in cats and no breed or gender predisposition has been found. Cats with ectopic ureters are incontinent and, in most of the cases, the ectopic ureters are extramural that terminate in the urethra (Mathews, 2017). Extravesicular ectopic ureters are most common finding in female cats (Berent & Mayhew, 2017). Cats that are affected with ectopic ureters show intermittent or persistent UI. This is often present from a young age and these cats are at increased risk for UTI. Other abnormalities of the urinary tract (hydronephrosis, hydroureter, renal hypoplasia) may be associated with ectopic ureters (Little, 2012).

1.2.5.5. Urethral hypoplasia

Urethral hypoplasia has been reported in immature female cats and is associated with UI with juvenile-onset (Kruger et al., 2017).

1.2.6. Feline idiopathic cystitis

FIC is the most common cause of chronic LUTS in cats under the age of ten. FIC is thought to be similar to interstitial cystitis (IC) in humans including the clinical signs, the tendency to reoccur, comorbid conditions and relation to stress. Although much of research has been done, the exact etiology of the disease is still unknown (Lund & Eggertsdóttir, 2019). Whether FIC could have a viral etiology remains speculated (Larson et al., 2011). It has been suggested that FIC can result when a *"sensitive individual' is exposed to a 'provocative environment"*. Sensitive individuals include cats with more vulnerability than resilience factors. This can sensitize the SRS to different threats. If the cats perception of threats exceeds its perception of control this can lead to chronic activation of the the SRS (Buffington & Chew, 2017). Clinical signs of FIC are similar to those of all FLUTD conditions: pollakiuria, hematuria and dysuria among others. Cats with FIC are more often male, overweight, live in a multi-cat household and have conflict with other cats (Cameron et al., 2004). The FIC cats are also more fearful and nervous, have a lower activity level and water intake and they hunt less (Defauw et al., 2011). They can also have an increased startle response, they can be aggressive and withdraw, or they can show more clinginess behavior (Horwitz & Rodan, 2018). Breed dispositions are variable and seem to depend on the geographical area and breed popularity in a certain country (Forrester & Towell, 2015).

In humans, IC is defined by the presence of hypersensitive bladder and the symptoms associated with it: pain in the bladder associated with urinary frequency, discomfort and nocturia. In this condition hypersensitive bladder symptoms are present but bladder pathology or other explainable diseases are unproven. In humans, IC is further divided based on bladder pathology to Hunner type IC with Hunner lesions or non-Hunner type IC with mucosal bleeding after distension in the absence of Hunner lesions (Homma et al., 2016). In cats, FIC is most similar to the non-Hunner subtype (Jones et al., 2021).

With cats, two LUTS forms have been reported – Type I, which is a non-ulcerative type and type II, which is an ulcerative type. The etiopathogenesis of these two types is different. Type I might be neuropathic in origin and type II appears to be an inflammatory disease that is intrinsic to the bladder. Cats have almost always type I form, in approximately 90% of cases (Buffington, 2011a; Kullman et al., 2018). Cats with FIC do not seem to have distinctive ulcerative areas of inflammation on the bladder wall, but several markers of inflammation have been found in the lamina propria (LP) of the bladder and urethra. Combinations of sterile inflammation, genetic susceptibility, aging and autoimmunity can lead to chronic inflammatory response that can result in urothelial injury (Kullman et al., 2018).

A lot of bladder abnormalities have been identified in cats with LUTS. According to Buffington (2011a) the abnormalities can be classified to local external and intrinsic abnormalities. Some of these factors have been proposed to cause the signs and symptoms of LUT in patients with FIC and IC. Patients with IC have an abnormality in Tamm-Horsfall (T-M) protein. T-M is glycoprotein that is found in abundance in normal patients. Differences in N-glycosylation have been found which indicates an altered T-H presence in patients with IC (Patnaik et al., 2017). Loss of T-M leads to loss of protection of the urothelium (Buffington, 2011a). Functional and anatomical changes in the urothelium have been reported with FIC and IC. Urothelium lines the distal portion of the urinary tract. A healthy urothelium maintains a barrier against the ion and solute flux but factors such as altered pH or infectious agents can impair the integrity of the barrier. Cats with FIC have significantly higher bladder permeability to sodium salicylate, increased urea and water permeability after hydrodistension of the bladder and reduced transepithelial resistance (Buffington, 2011a). Glycosaminoglycan (GAG) layer coats the inner surface of the lower urinary tract. Cats with FIC can have abnormalities with the layer and decreased total GAG

have been reported in cats with FIC (Buffington, 2011a). Buffington & Pacak (2001) have reported that cats with FIC have significantly increased concentration of plasma norepinephrine compared to healthy cats. Westropp et al. (2003) reported that FIC cats have significantly smaller adrenal glands compared to healthy cats and that FIC cats may have a mild primary adrenal insufficiency. Several other abnormalities have also been reported in cats with FIC – increased sympathetic activity on bladder function (Buffington et al. 2002), higher serum cytokine concentration (Parys et al., 2018), decrease in Trefoil factor 2 (Lemberger et al., 2011a), higher urine protein creatinine (UPC) ratio and higher N-acetyl-β-D-glucosaminidase (NAG) index (Panboon et al., 2017), significantly greater urine fibronectin content (Lemberger et al., 2011b), accumulation of leukocytes and altered numbers of mast cells in the bladder and proximal urethra, and increased suburothelial proliferation (Kullman et al., 2018), among many others.

In addition, decreased urination frequency and urine volume can further complicate FIC due to the increased contact time of highly concentrated urine with uroepithelial tissue. There are many reasons for altered urinary habits including environmental factors, poor water consumption, litter box availability and cleanliness and impaired mobility due to illness (Forrester & Towell, 2015).

1.2.6.1. Obstructive feline idiopathic cystitis

Obstructive FIC can be caused by a functional or mechanical reason. Functional obstruction can happen due to urethral inflammation, urethral sphincter contraction or dyssynergia of the bladder sphincter. Mechanical blockage of the urethra can result from urethral plugs (commonly struvite crystals with matrix) and lead to complete obstruction and postrenal azotemia (Lew-Kojrys et al., 2017).

1.2.6.2. Non-obstructive feline idiopathic cystitis

Cats with non-obstructive FIC have patent urethra so they are able to pass urine. Activation of the SRS can increase epithelial permeability and activate local neurogenic inflammation in the bladder. The cat can have pelvic organ pain and small bladder with thickened bladder walls (Chew & Buffington, 2009).

1.2.6.3. Pandora syndrome

Buffington and colleagues have proposed the term ’Pandora syndrome’ to describe cats with chronic LUTS in the presence of other comorbid disorders until more appropriate terminology is available. Pandora syndrome is thought to be similar to medically unexplained chronic functional syndrome is humans (Buffington, 2011b; Buffington et al., 2014). The term ‘Pandora syndrome’ does not identify any specific organ or cause and it seems to capture the wide spectrum of the problems outside the bladder. Some criteria for diagnosing ‘Pandora syndrome’ include patient with waxing and waning of severity of clinical signs, evidence of early adverse experiences, presence of clinical signs that refer to other organs system than what the patient is being evaluated for and resolution of signs associated with multimodal environmental modification (MEMO) (Buffington et al., 2014).

1.3. Diagnosing of feline lower urinary tract disease

Diagnostic methods of FLUTD should be assessed and decided based on the severity of the clinical signs and the recurrence of the FLUTD conditions. It should always include a thorough dietary and medical history along with a physical examination (Little, 2012). A urinalysis and urine bacterial culture should be analyzed. Abdominal radiographs should be evaluated as bladder stones are present in approximately 20% of cats with LUTS. Advanced diagnostic tests include abdominal ultrasonography, cystoscopy and contrast cystourethrography. Currently, with no well-accepted tests, FIC is a diagnosis of exclusion (DiPartola & Westropp, 2020).

1.3.1. Urinalysis

Urinalysis includes assessment of the physical and chemical properties of the urine. There´s no need for specialized equipment and it is routinely performed in veterinary clinics. Urinalysis can provide important information about the urinary tract and can also be an indicator of disease states of the endocrine system or liver (Alleman & Wamsley, 2017). Interpretation and results of urinalysis can be influenced by the collection method of the urine, timing of the urine sample collection, any possible prior administration of therapeutic or diagnostic agents and handling of the urine sample prior the analysis. Urine sample should be collected before administration of fluids or diuretics. There are several methods for urine collection including naturally voided urine, catheterization and cystocentesis. Naturally

voided urine collected midstream and cystocentesis are often the preferred choices (Alleman & Wamsley, 2017).

Complete urinalysis includes visual inspection of the urine, urine specific gravity (USG), dipstick and urine sediment analysis and urine culturing.

1.3.1.1. Visual inspection of urine

Urochromes are natural urine pigments that are responsible for the yellow color of urine. Normal urine may be various shades of yellow due to these pigments. Urine that is well concentrated is often darked shade of yellow but this is not always the case. Bilirubinuria can color the urine to dark yellow– orange colour and give the false impression of concentrated urine. Exposure to light alters the color of urine, making it darker. The color can also be affected by the presence of substances that are not normally found in urine (haemoglobin, myoglobin). Normal urine is transparent or slightly cloudy. Increased cloudiness can be an indicator of the presence of cells, crystals or microorganisms (Alleman & Wamsley, 2017).

1.3.1.2. Urine specific gravity

USG is an indication of renal function and is used to determine the ability of renal tubules to conserve water and produce well concentrated urine (Alleman & Wamsley, 2017; Graham, 2017). Normal reference values for dogs and cats are wide ranging from 1.001-1.080. The age of the animals, time of collection of the sample or water intake all affect USG values so interpretation must take those factors into consideration (DiPartola & Westropp, 2020).

1.3.1.3. Dipstick analysis

Urine pH, protein, blood, glucose, bilirubin and ketones are commonly evaluated with dipstick analysis. pH can vary depending on the cats diet and acid-base balance. Normal urine pH is approximately between 5.0 and 7.5. Urine pH in cats is often underestimated with the dipstick analysis. pH should also be evaluated together with other urinalysis findings (Alleman & Wamsley, 2017; DiPartola & Westropp, 2020). Protein determination in dipstick is more sensitive to albumin than globulins. Persistent low-level proteinuria is an

indication of deterioration in renal function in cats. However, queens and neutered cats have relatively high level of false-positive results because of the enzyme cauxin so proteinuria has to be evaluated together with a complete history of the patient, physical examination and evaluation of urine sediment (Roura et al., 2017; DiPartola & Westropp, 2020). Blood is not found in normal urine of cats. It´s often free hemoglobin secondary to hemolysis – this could be caused by immune-mediated hemolytic anemia (IMHA), disseminated intravascular coagulation (DIC) or heat stroke (DiPartola & Westropp, 2020). Glucose is reabsorbed almost completely by the kidneys and should not be present in the urine of cats. Most common reasons for glucosuria in cats include DM, stress and excitement (Alleman & Wamsley, 2017; DiPartola & Westropp, 2020). Bilirubin should be absent from the urine of cats. Cats have a high renal threshold for bilirubin excretion and therefore even small amount is clinically significant and indication of a disease process associated with hyperbilirubinaemia (Alleman & Wamsley, 2017). Ketones are not found in the normal urine of cats. Ketones can found in the urine in case of poorly regulated diabetic patients with diabetic ketoacidosis, starvation, persistent fever and persistent hypoglycemia (Alleman & Wamsley, 2017; DiPartola & Westropp, 2020).

1.3.1.4. Urine sediment

Urine sediment is analyzed microscopically to detect abnormal concentrations of erythrocytes, leucocytes, crystals and bacteria. These findings can indicate a urinary tract disease (Alleman & Wamsley, 2017). Occasional red blood cells in urine sediment are considered normal. Also the collection method of urine influences the amount of blood in the sediment. Inflammation, thrombocytopenia, neoplasia or infection can cause hematuria (Alleman & Wamsley, 2017; DiPartola & Westropp, 2020). Only few leucocytes should be present in urine that is collected by cystocentesis. Abundant leucocyte numbers with concurrent bacteriuria indicate urinary tract inflammation with primary or secondary bacterial infection (Alleman & Wamsley, 2017). Crystals occur in urine when it is saturated with dissolved minerals or other crystallogenic substances that precipitate to form crystals. Crystalliuria does not necessarily indicate a pathological process and is often found in small numbers in clinically healthy cats. The importance of crystals in urine have to be evaluated together with other urinalysis findings (Alleman & Wamsley, 2017). Bacteria in urine is often due to UTI but absence of pyoruria does not exclude the possibility of UTI so urine culturing in these cases should be done. Bacteria can multiply also after urine collection so

this has to be taken into consideration when analyzing the sediment (Alleman & Wamsley, 2017).

1.3.1.5. Urine culturing

Cats have a relatively low likelihood of bacterial cystitis. Therefore, the diagnosis should be based on urine culturing results (Weese et al., 2019). Clinical signs and other urinalysis findings can support the diagnosis but microbiology is required for definitive diagnosis of UTI. Urine culturing should be done from a sterile sample to prevent false-positive results. *Escherichia coli* is the most common finding in cats with UTI (DiPartola & Westropp, 2020).

1.3.2. Radiography

Radiographs can be used to evaluate the presence of the most common calculi reported in cats (struvite and CaOx). These calculi are radiodense, while urate and cystine calculi are much less radiodense and can go unnoticed. Radiographs can also be used to evaluate the size of calculi (Westropp & Lulich, 2017; Westropp & DiPartola, 2020). Radiographs also give indication of the bladder size and location. In case of trauma, a pelvic fracture can be seen on radiographs (Lipscomb, 2017).

1.3.3. Ultrasonography

Ultrasonography can be used to identify calculi in the lower urinary tract. Ultrasonography can be used in identification of the bladder, its size and location as well as bladder wall lesions, thickening or neoplasia. It is also used to aid in cystocentesis in the collection a sterile urine sample (Lipscomb, 2017).

1.4. Treatment of feline lower urinary tract disease

1.4.1. Uroliths

Treatment options for feline uroliths depend on the patient and the type and size of uroliths present. Most cystoliths are removed with cystotomy but other methods exist too. Less invasive method is to perform laparoscopic-assisted cystostomy but often it is easier to perform the routine surgery. If the uroliths are small enough in a female cat, non-invasive

voiding urohydropulsion can be attemped. This method, however, should not be performed with male cats (Labato, 2017).

1.4.1.1 Struvites

For treatment of struvite uroliths there are several therapeutic foods for the dissolution of the uroliths. The diets are formulated with restricted magnesium and phosphorus and to maintain an acidic urine pH. In addition to the diet, other treatment methods include the ones mentioned previously (Labato, 2017).

1.4.1.2. Calcium oxalate

Currently no protocol exists for dissolving CaOx and the only effective treatment is the removal of the uroliths. One of the most important dietary modifications is to try to increase the cat's water intake and urinary volume as the risk for CaOx formation is lower with diets with higher moisture content. Some therapeutic diets with restricted protein and higher sodium chloride (NaCl) content exist. Adding NaCl decreases the supersaturation of CaOx in healthy cats (Labato, 2017). Medical therapy can be considered, if dietary therapy is not effective alone. Potassium citrate has been used in success with humans as a urine alkalinizing agent but currently no clear benefit has been shown with use in cats. Thiazide diuretics are another option to reduce CaOx saturation. These diuretics inhibit sodium-chloride cotransporter. This causes stimulation of calcium reabsorption and decrease in urinary calcium excretion (Labato, 2017).

1.4.2. Bacterial cystitis

When true UTI is diagnosed, antimicrobials remain the standard of treatment protocol. The treatment will vary depending on the cat´s condition, previous UTI's and possible comorbid conditions. Nonsteroidal anti-inflammatory drugs (NSAID) are used to alleviate pain associated with bacterial cystitis (Wood, 2017).

1.4.2.1 Sporadic bacterial cystitis

Antimicrobial treatment is indicated when the aerobic urine culture is positive. Amoxicillin or amoxicillin/clavulanic acid are reasonable first choice antimicrobials. Trimetoprim-sulfonamides are other option but greater adverse effects have been reported. The

recommended duration of the treatment is 3-5 days, optimally the shorted end of dosing period (Weese et al., 2019).

1.4.2.2. Recurrent bacterial cystitis

Previously a longer duration of antimicrobial therapy was recommended for recurrent cystitis (up to four weeks). Recurrent cystitis, however, emcompasses a wide range of conditions and therefore the treatment should be planned according to the nature of the infection. In humans, short-course antimicrobial therapy for recurrent and acute bacterial cystitis has proved to be beneficial (Weese et al., 2019). Empirical therapy can be started while awaiting urine culture results and the choice of antibiotic is assessed again based on culture results and patient response. Short antimicrobial therapy (3-5 days) can be considered with reinfection and longer courses (7-14 days) with relapsing and persistent infections. In case of recurrent bacterial cystitis, the possible underlying condition should be identified (eg. a micturition disorder). Analgesic should be prescribed for managent of the pain caused by the infection (Weese et al., 2019).

1.4.3. Urethral plugs

In case of urethral plugs, the first aid treatment is to unobstruct the cat. Sometimes a decompressive cystocentesis must be performed. Often catheterization is the treatment option if there´s a complete obstruction. It is important to try not to force or push luminal contents with the catheter. It´s possible to gently massage the distal urethra to try to disrupt any urethral plug present. Sometimes, urethral plugs can be passed with complete urethral relaxation (Lulich & Osborne, 2017).

1.4.4. Neoplasia

The best treatment for lower urinary tract tumors in cats is currently not known. Neoplasias are often dignosed when advanced and the cat can have other concurrent diseases that complicate the situation even more. Depending on the location of the tumor it can be surgically resected (apex or body of the bladder) but risk for recurrence and metastasis is high. TCC is often found in the trigone area of the bladder where it´s not possible to surgically operate it. If TCC is found in the urethra, combination of surgery and radiation

are possible treatment options (Little, 2012). Other treatment options include partial cystectomy, chemotherapy, urethral stent placement and NSAIDs (Griffin et al., 2020).

1.4.5. Micturition disorders

Micturition disorders in cats are much more uncommon than in dogs. There´s also not many studies done on cats or they have focused primarily on congenital causes. There are number of therapeutics employed so assessing the treatment outcomes for a single disease is difficult. Spinal cord diseases have more unfavourable outcome to bladder and urethral disorders (Lonc et al., 2020).

Therapeutics for different micturition disorders include surgical and medical treatments and combinations of these. Medications used in micturition disorders include phenylpropanolamine and deslorin and these have been shown to be affective in some cats with UI (Pisu & Veronesi, 2014; Lonc et al., 2020).

1.4.6. Feline idiopathic cystitis

The aetiopathogeneses of FIC is still poorly understood. Therefore, management of FIC remains challenging and not many of the interventions recommended have been proven effective. FIC clinical signs are often recurrent but solve within a few days in most of the cats. This makes the assessment of different therapies challenging (Sparkes, 2018).

1.4.6.1. Obstructive feline idiopathic cystitis

Obstructive FIC is always an emergency. When there´s a diagnosis of obstruction, the cat should be immediately assessed and stabilized with intravenous fluids. Biochemistry panel and electrolytes should be submitted to analyze hyperkalemia, hypocalcemia and postrenal azotemia. Decompressive cystocentesis can be performed as a reservoir for urine flow. Once the cat is anethesized, the obstruction can be removed. Obstruction is removed with cathetherization in most cases with an open-ended nonmental catheter. The bladder is flushed several times with saline before removing the catheter. Sometimes an indwelling urinary catheter placement is indicated – this is the case with cats with severe azotemia, detrusor atony or an obstruction caused by calculi. Analgesics are an important component of treatment of obstructive FIC. Analgesic choice includes opioids, eg. buprenorphine.

NSAIDs should not be administered before assessment of kidney values. To decrease possible urethral spasms, alfa 1-antagonists (eg. prazozin) can be administered (Westropp & DiPartola, 2020), however, recently Hanson et al. (2021) postulated that it might not be benefial in prevention of UO.

1.4.6.2. Non-obstructive feline idiopathic cystitis

Clinical signs of non-obstructive FIC often resolve within 2-3 days in majority of cases. Analgesic therapy is one of the most important treatments in acute FIC. Depending on the severity of pain analgesic options include buprenorphine, fentanyl patch and NSAIDs. As no cure for FIC has been found, the treatment options are aimed at clinical recovery and increasing the disease-free survival time (Westropp & DiPartola, 2020). Other medications and supplemental therapies that are used with cats with FIC include GAG supplementation, amitriptyline and synthetic feline facial pheromones (Sparkes, 2018).

1.4.6.3. Multimodal environmental modification

An important component in managing FIC is MEMO. MEMO aims to modify the cat´s environment in attempt to reduce LUTS. Changes in the cat´s life include more positive interactions with humans, attempts to change cats physical environment, changes in feeding (switching to canned food), increase in the number of litter boxes and reducing conflicts between cats. MEMO tries to include and extend the concept of environmental enrichment to include several different features in the cat's environment. These changes lead to significant reduction in nervousness, fearfulness and aggressiveness of the cats with FIC (Buffington et al., 2006).

2. AIMS OF THE STUDY

A questionnaire was to sent to veterinarians in Finland and Estonia:

To investigate, how veterinarians in Finland and Estonia approach FLUTD.

To investige, whether there are differences in how veterinarians in Finland and Estonia approach the disease.

To investigate, whether there are significant differences in diagnoses of FLUTD or the treatment recommendations between veterinarians who work in a normal practice vs. veterinarians who work in a specialized clinic.

To compare the overall results of this questionnaire with the existing scientific literature.

3. MATERIALS AND METHODS

3.1. Questionnaire

A questionnaire was formed firstly in English and it included both open and multiple choice questions. The planning of the questionnaire started in the spring of 2019. There were 58 questions altogether. There were questions about the terminology of FLUTD, anamnesis, diagnostics, treatment and FIC. The questionnaire was then translated to Finnish (Appendix 1) and Estonian (Appendix 2). The Estonian translation was also checked for grammar by the Language Center (Keelekeskus) of the university. Veterinarians in Finland and Estonia participated in an online questionnaire between June 2020 and October 2020. Web-based survey software, QuestionPro, was used for the formation of the questionnaire. The questionnaire platform was then tested before sending out the link to the actual questionnaire. With the questionnaire, an introductory text was included, where the aims of the study were explained together with the quarantee of anonymity in case of participation. It was not possible to answer the questionnaire more than once.

There were 59 completed answers in the Finnish questionnaire and 17 in the Estonian one. The questionnaires were viewed altogether 459 times (FIN 295, EST 164). There were 106 started (FIN 59 and EST 47) questionnaires and 30 dropouts altogether (FIN 0 and EST 30). The completion rates were 100% (FIN) and 36.2% (EST). The average time it took respondents to answer the questionnaire was 19.7 minutes (FIN) and 19.5 minutes (EST). After the questionnaire closed, the raw data was downloaded from the QuestionPro-platform to Microsoft Office Excel-spreadsheet. The respondents were numbered but there was no possibility to identify individual's identity. After completion of the study the data was appropriately discarded.

3.2. Statistical analysis

Most of the data was described using descriptive statistics. To investigate, whether there

were differences with the data with veterinarians who work in a specialized clinic vs. veterinarians who work in non-specialized clinic or veterinarians from Finland vs. Estonia logistic regression analysis was used. For logistic regression questions, answers “yes” and “sometimes” were considered to be “yes”. In the case of questions, where multiple answers were allowed, logistic regression model was used where all possible were included as to level categorical variables (yes or no). When yes or no answers to some question in veterinarians’ group were 100% or 0% then Fisher exact test was used (e.g. antibiotic prescription between Finnish and Estonian veterinarians). Specific questions analysed with logistic regression were:

Do veterinarians who work in specialized clinic or in different countries -

- prescribe more/fewer analgesics/or other medications? Do they recommend more/fewer additional treatments?
- recommend acupuncture for FIC?
- recommend MEMO more often/or sooner? Do they generally know more often about MEMO?
- recommend different treatment/treatments?
- use different diagnostics methods?

Statistical software used for logistic regression models was STATA 14.2 (Stata Corp, Texas, USA). P-value of ≤ 0.05 was considered significant. The data handling and descriptive statistics were done with Microsoft Excel 2016 (Microsoft, USA)

4. RESULTS

4.1. Signalment

Veterinarians in Finland and Estonia described FLUTD in a similar manner. Most mentioned the complexity of the disease involving the bladder and urethra, including FIC, UTI, urolithiasis among others. It was also mentioned that FLUTD is an umbrella term, and all of the diseases cannot be described with one word. FLUTD was seen as a painful disease with inflammation, hematuria, periuria and other difficulties with urinating. Most of the cats presented to the clinics (FIN & EST, table 3) with FLUTD symtoms were castrated males who were under 10 years old and were overweight. This finding is in line with previous studies where FLUTD has been shown to affect mostly indoor, spayed cats with higher BCS.

Table 3. Age, sex, weight and neuter status of cats presented to the clinics.

Variable	**Finland**		**%**	**Estonia**		**%**
Age	n = 59	Under 10 Years Over 10 years	84.7 15.3	n = 17	Under 10 Years Over 10 years	94.1 5.9
Sex	n = 55	Female Male	25.5 74.5	n = 17	Female Male	17.6 82.4
Weight	n = 59	Underweight Normal weight Overweight	0.0 23.7 76.3	n = 17	Underweight Normal weight Overweight	5.9 23.5 70.6
Neutered female	n = 59	Yes No	100.0 0.0	n = 17	Yes No	100.0 0.00
Neutered male	n = 58	Yes No	98.3 1.7	n = 17	Yes No	100.0 0.0

According to the owners, FLUTD-symptoms had lasted less than a week (FIN 81,4%, EST 94,1%). It was common for the FLUTD to be a recurrent condition (FIN 83,1%, EST 94,1%).

Most commonly described FLUTD-symptoms by the owners (figure 1) included frequent urination (FIN 18.9%, EST 16.3%), periruria (FIN 17.9%, EST 13.3%), hematuria (FIN 16.9%, EST 14.3%), stranguria (FIN 15.2%, EST 10.2%) and anuria (FIN 8.3%, EST 10.2%). Pollakiuria seems to be more commonly described by the owners in Estonia (FIN 7.6%, EST 14.3%). Other symptoms described included apathy, restlessness, anorexia, excessive vocalization, constipation and alopecia in the abdominal area.

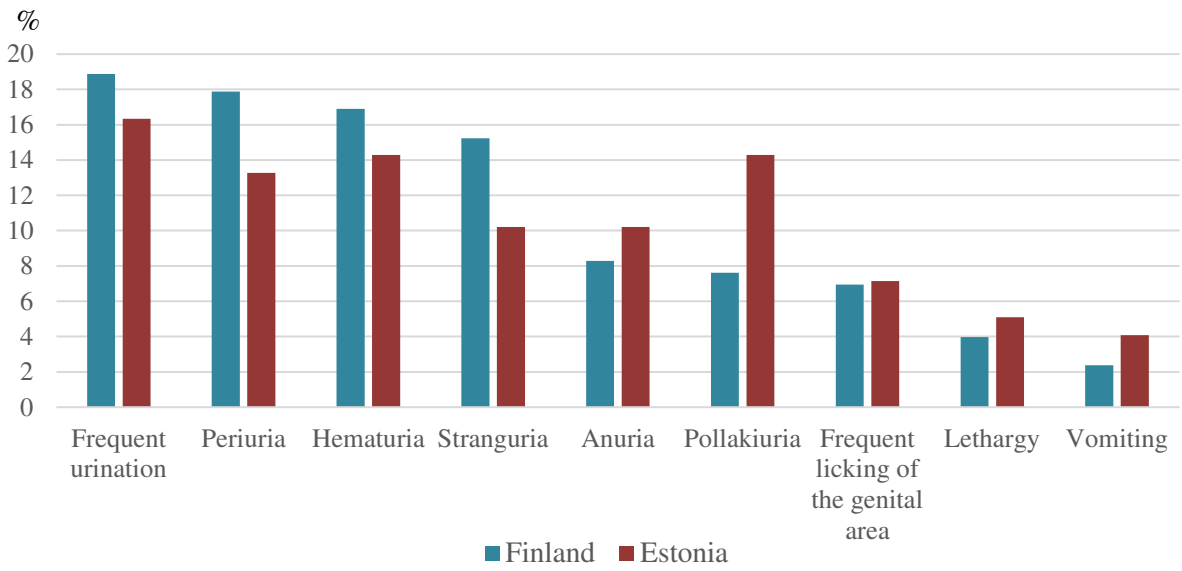

Figure 1. Most common feline lower urinary tract disease (FLUTD) symptoms described by the owners.

The clinical signs seen in the clinics reported by the veterinarians are summarised in table 4.

Table 4. Most common clinical symptoms of feline lower urinary tract disease (FLUTD) seen in clinics.

Common clinical symptoms		
Irritated genital area	Lethargy	Anorexia
Painful abdominal palpation	Ventral alopecia	Apathy
Painful bladder palpation	Dehydration	Restlessness
Distended bladder	Tachycardia	Aggressive behavior
Hematuria	Excessive vocalization	Bradycardia

Most common FLUTD conditions included FIC (FIN 18.1%, EST 15.5%), UO (FIN 18.1%, EST 15.5%), behavioral disorders (FIN 17.1%, EST 12.7%), UTI (FIN 16.8%, EST 14.6%) and urolithiasis (FIN 15.9%, EST 15.5%) in both countries. It seems that in Estonia trauma and neurologic disorders are more common reasons for FLUTD than in Finland. The causes for FLUTD are summarized in figure 2.

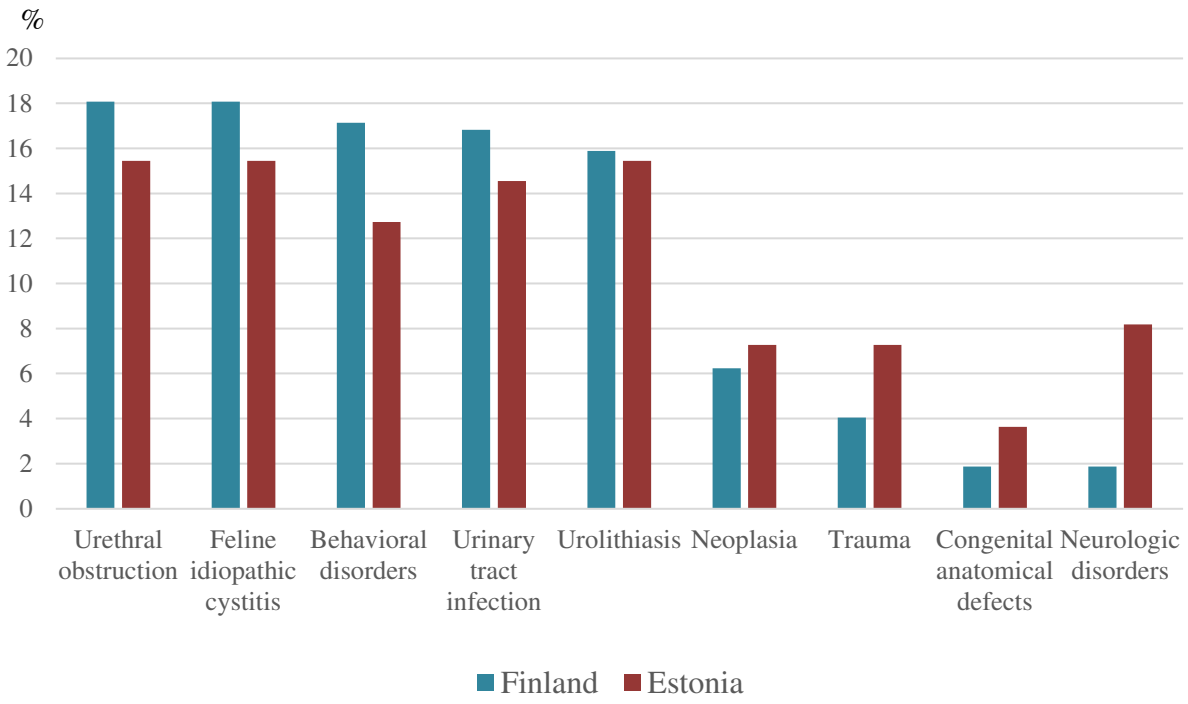

Figure 2. Most common causes for feline lower urinary tract disease (FLUTD).

Veterinarians working in Finland diagnosed neurological disorders over two times less often than in Estonia (OR = -2.29, 95% CI: -3.82-(-0.76), p = 0.003; figure 2) and veterinarians working in specialized clinics diagnosed neurological disorders almost two times more often than veterinarians working in non-specialized clinics (OR = 1.75, 95% CI: 0.14-3.35, p = 0.033; table 5).

Table 5. Feline lower urinary tract disease (FLUTD) diagnoses in specialized and non-specialized clinics.

Which of the following FLUTD conditions have you encountered in your clinic?	**Specialized clinic n = 10**		**Non-specialized clinic n = 66**		
Diagnosis	**Yes n (%)**	**No n (%)**	**Yes n (%)**	**No n (%)**	**p-value***
Feline idiopathic cystitis	10 (100)	0 (0)	65 (99)	1 (2)	–
Urolithiasis	10 (100)	0 (0)	58 (88)	8 (12)	–
Urethral obstruction	10 (100)	0 (0)	65 (99)	1 (2)	–
Urinary tract infection	10 (100)	0 (0)	60 (100)	6 (9)	–
Neoplasia	4 (40)	6 (60)	24 (36)	42 (64)	0.984
Congenital anatomical defects	1 (10)	9 (90)	9 (14)	57 (86)	0.236
Trauma	5 (50)	5 (50)	16 (24)	50 (76)	0.311
Neurologic disorders	5 (50)	5 (50)	10 (15)	56 (85)	0.033
Behavioral disorders	9 (90)	1 (10)	60 (91)	6 (9)	0.974

* Evaluated by logistic regression model. Model will not calculate p-value (–) if outcome in one group is perfect (100% or 0%).

4.2. DIAGNOSTICS

Most common diagnostic methods used for FLUTD diagnoses were ultrasound and urinalysis in both countries. In Estonia, radiograph diagnostics were used almost as often as ultrasound. Blood samples were also taken, especially if the cat was older or there was any suspicion of an underlying disease such as kidney disease. Blood samples were much more commonly taken in Estonia. It was also mentioned that a thorough anamnesis and clinical examinations are important. Abdominal palpation, temperature measurement, and urinalysis (USG, dipstick, urine culturing) were done as often in both countries.

Veterinarians in Estonia enquired more often about the cats diet than veterinarians in Finland (FIN 81.4%, EST 100%). Enquirying about urinary habits (house soiling, frequency of urination) was done sometimes in almost fifth (17.7%) of the cases in Estonia, whereas in Finland it was almost always done. In Estonia, it was also much more common to collect free voided urine or urine with catheterization than in Finland, however, cystocentesis was the most commonly used method for urine collection in both countries (FIN 79.7%, EST 76.5%). Radiographs were taken much more often in Estonia than in Finland and, if radiographs were taken, it was more common to take them in almost half of the patients.

Hematology values were taken more often in Estonia. Biochemistry values were taken also more often in Estonia (FIN 23.7%, EST 64.7%) and most often they were taken in case of all cats with FLUTD. Other reasons to take biochemistry values in Estonia were in case of UO, low USG, suspicion of CaOx-uroliths, older cat that is unwell or other symptoms such as increased drinking and poor apetite. In Finland, biochemistry values were taken in similar cases than in Estonia: from older animals with suspicious symptoms to find out about possible comorbidities or in case of UO, low USG or uremia. Some veterinarians recommended biochemistry values to be always taken with FLUTD cats, but mentioned that the owner's financial situation may not always allow that. Serum amyloid A (SAA)-value was not commonly checked. Electrolytes were checked approximately in one fifth of the cases in Finland and in one third of the cases in Estonia. Electrolytes were most commonly checked in case of suspected UO in both countries. Diagnostic methods are summarized in table 6.

Table 6. Different diagnostic methods used in clinics.

Variable	Finland (n = 59)			Estonia (n = 17)		
	Yes %	No %	Sometimes %	Yes %	No %	Sometimes %
Abdominal palpation	98.3	0.0	1.7	94.1	0.0	5.9
Temperature measurement	35.6	15.3	49.2	35.3	0.0	64.7
Diet enquiry	81.4	0.0	18.6	100.0	0.0	0.0
Enquiry of urinary habits	98.3	0.0	1.7	82.4	0.0	17.7
Urinary USG measured	91.5	3.4	5.1	100.0	0.0	0.0
Dipstick analysis	100.0	0.0	0.0	100.0	0.0	0.0
Sediment analysis	100.0	0.0	0.0	100.0	0.0	0.0
Urine culturing	66.1	5.1	28.8	58.8	5.9	35.3
Collection of free flow urine	10.3	65.5	24.1	29.4	23.5	47.1
Collection of urine with catheterization	8.5	22.0	69.5	35.3	41.2	23.5
Collection of urine with cystocentesis	79.7	1.7	18.6	76.5	5.9	17.7
X-rays commonly taken	1.7	37.3	61.0	41.2	11.8	47.1
Ultrasound examination commonly performed	91.5	0.0	8.5	94.1	5.9	0.0
Hematology values commonly checked	13.6	11.9	74.6	47.1	5.9	47.1
Biochemistry values commonly checked	23.7	3.4	62.7	64.7	5.9	29.4
SAA value commonly checked	0.0	57.6	42.4	0.0	88.2	11.8

Electrolytes commonly checked	18.6	10.2	71.2	35.3	17.7	47.1

USG = Urine specific gravity, SAA = Serum Amyloid A

4.3. Treatment

Antimicrobials were prescribed in case of bacteriuria (41.2%) and after urine culturing results (41.2%) in Estonia. Interestingly, 5.9% prescribed antimicrobials prophylactically and 88.2% prescribed antimicrobials sometimes. In Finland, antimicrobials were prescribed most commonly after urine culturing results (74.2%). 40.7% of veterinarians in Finland did not prescribe antimicrobials in case of FLUTD. Overall, antimicrobials were more commonly (answers yes and sometimes) prescribed in Estonia (Fisher exact test p = 0.001; table 7). NSAIDs and opioids were prescribed similarly in both counties.

Most veterinarians recommended prescription diets in Estonia but in Finland only approximately half of the respondents recommended a diet (FIN 55.9%, EST 94.1%) to FLUTD cats. Most commonly prescription diets were recommended in case of crystals, uroliths or FIC. The most common foods that were recommended included dissolution diets, calming diet and increasing of wet food in the diet. Urine acidifying supplements were recommended more often in Estonia (23.5%) than in Finland (3.4%) as well as GAG supplements (FIN 25.4%, EST 52.9%). Increase in the cat's water intake was recommended commonly in both countries. Treatments are summarized in table 7.

Table 7. Treatment and treatment recommendations of feline lower urinary tract (FLUTD).

Variable	Finland (n = 59)			Estonia (n = 17)		
	Yes %	No %	Sometimes %	Yes %	No %	Sometimes %
Prescribe antibiotics	5.1	40.7	54.2	11.8	0.0	88.2
Prescribe NSAIDs	93.2	1.7	5.1	88.2	5.9	5.9
Prescribe opioids	32.2	22.0	45.8	47.1	11.8	41.2
Recommend a prescription diet	55.9	0.0	44.1	94.1	0.0	5.9
Recommend urine acidifying supplements	3.4	61.0	35.6	23.5	17.7	58.8
Recommend glycosaminoglycan layer supplements	25.4	22.0	52.5	52.9	17.7	29.4
Recommend increase in water intake	91.5	1.7	6.8	88.2	0.0	11.8

Out of the respondents, 8.5% (FIN) and 29.4% (EST) were working in a specialized clinic (eg. cat friendly clinic, clinic specialized in cats, university clinic).

4.4. Feline idiopathic cystitis

FIC was described as a sterile inflammation of the bladder often caused by stressful events in the cat's life and resembling UTI with hematuria, stranguria and pollakiuria. Diagnostic methods included thorough anamnesis and excluding other causes for FLUTD (eg. culturing of urine, sediment analysis, dipstick analysis). It was more common for FIC to be a recurrent condition (FIN 89.7%, EST 100%). Most of the veterinarians inquired about any recent changes in the cat's life (FIN 96.6%, EST 100%).

NSAIDs were used in the treatment of FIC in both countries. In Finland, they were almost always prescribed (98.3%) and in Estonia a little less frequently. Opioids were prescribed in both countries about 70% of the time, including prescribing opioids sometimes. Antidepressants were not commonly prescribed. In Finland and Estonia antidepressants were prescribed most commonly in case of recurrent FIC (FIN 67.5%, EST 53.9%). Veterinarians in both countries prescribed antidepressants in case of chronic FIC and if the stressors could not be eliminated from the cat's life. Anxiety relieving supplements were recommended more often in Finland (FIN 44.1%, EST 35.3%). Feline facial pheromone was more commonly recommended in Estonia than in Finland (FIN 71.2%, EST 94.1%). Acupuncture in the treatment of FIC was not commonly recommended. The treatments for FIC are summarized in table 8.

Table 8. Treatment and treatment recommendations of feline idiopathic cystitis (FIC).

Variable	Finland (n = 59)			Estonia (n = 17)		
	Yes %	No %	Sometimes %	Yes %	No %	Sometimes %
Prescribe NSAIDs	98.3	1.7	0.0	70.6	5.9	23.5
Prescribe opioids	23.7	28.8	47.5	29.4	29.4	41.2
Prescribe antidepressants	5.1	33.9	61.0	5.9	23.5	70.6
Recommend anxiety relieving supplements	44.1	17.0	39.0	35.3	41.2	23.5
Recommend products with feline facial pheromone	71.2	5.1	23.7	94.1	0.0	5.9
Recommend acupuncture	1.7	79.7	18.6	5.9	94.1	0.0

Veterinarians working in specialized clinic recommended acupuncture approximately four times more often (answers yes or sometimes) than veterinarians working in non-specialized clinic (OR = 4.22, 95% CI: 1.0-18.0; table 8). However, this result was close to be significant (p = 0.051).

When comparing veterinarians working in Finland and Estonia, a statistically significant finding was that veterinarians in Finland recommended anxiety relieving supplements more (answers yes or sometimes) than veterinarians in Estonia (OR = 1.23, 95% CI: 0.05-2.05, p = 0.041; table 8). No other statistically significant findings arose from the data.

MEMO was familiar or had been heard with over 85% of veterinarians in both countries (FIN 84.7%, EST 88.2%). In Finland, almost 50% of the veterinarians recommended MEMO during the first episode of FIC. In Estonia, MEMO was recommended equally during the first and recurrent episodes of FIC.

The most commonly recommended environmental modifications included adding more litter boxes, offering multiple drinking points, offering a quiet area dedicated only for the cat and mental stimulation. MEMO recommendations are summarized in table 9.

Table 9. Multimodal environmental modification (MEMO) recommendations by the veterinarians.

Recommended environmentalmodification	**FIN %**	**EST %**
More litter boxes	12.4	12.6
Different litters	9.3	6.7
Vantage points	8.1	8.9
Scratching posts	6.8	8.2
Multiple drinking points	12.0	11.9
Mental stimulation	10.5	6.7
Outdoor access	4.9	5.2
Cat videos	2.0	2.2
More time with the owner	6.3	7.4
Enriching toys	8.5	9.6
Quiet area only for the cat	10.7	10.4
Resting places	7.1	9.6
Something else	1.5	0.7

5. DISCUSSION

In this study FIC, uroliths and UTI were most commonly encountered FLUTD conditions in both countries. Several studies have similar findings where the most common causes for FLUTD include FIC, uroliths and UTI (Gunn-Moore, 2003; Defauw et al., 2011; Buffington & Bain, 2020; Kaul et al., 2020). Most of the cats presented to the clinics in Finland and Estonia were less than 10 years old, male, neutered and overweight. As FIC remains one of the most common reasons for FLUTD and often affects cats that are male, less than 10 years old with comorbidities such as obesity, these findings are similar to previous ones (Gunn-Moore, 2003; Chew & Buffington, 2009). However, a study by Longstaff et al. (2017) reported no significant associations between owner reported LUTS and the commonly reported risk factors. Therefore, it´s important not to rule out FLUTD in cats that do not fit the commonly reported risk groups. Common FLUTD signs include hematuria, periuria, stranguria and pollakiuria. These clinical signs can occur with any FLUTD condition (Sharp, 2020). Similar findings arose from this study, where frequent urination, periuria, hematuria and stranguria were the most common clinical symptoms described by the owner.

Initial and advanced diagnostics for FLUTD include urinalysis, urine culturing, diagnostic imaging, complete blood count and biochemistry to mention a few (Forrester & Towell, 2015; Sharp, 2020). The most common diagnostics done were urinalysis and ultrasound in Finland and Estonia. Blood values were also quite commonly checked. SAA-value was not commonly checked. SAA has been reported to show difference to normal SAA value in cats with FLUTD (Sasaki et al., 2003). A more recent study by Yuki et al. (2020) found that SAA concentrations in cats with lower urinary tract disease were significantly higher than the SAA concentrations in age-matched healthy cats. It has also been reported that women with cystitis have a higher than normal SAA levels (Lannergård et al., 2003). It is possible that SAA is not commonly measured as other diagnostic methods for FLUTD are often sufficient. Another reason why SAA-value is not checked could be the financial aspect – FLUTD can be a challenging and recurrent disease to treat and owners are required to be financially willing to pay for different diagnostics. However, in some of the more challenging cases, it could be reasonable to control SAA-value as well.

Enquiring about the cats diet was done always in Estonia but in Finland only a little over 80% of cases. This is interesting as it is important to know what food is the cat being fed, or whether the cat has been on a therapeutic diet before. It is also important to know, whether the diet has been recently changed. Cats are sensitive to flavor differences in food and can be quite discriminating in food selection but are not able to show that very clearly (Pickering, 2009). A sudden change in the diet or food aversion could cause stress to the cat and this can lead to different FLUTD conditions such as FIC.

Enquiring about urinary habits was done in both countries almost always. However, in Estonia almost one fifth enquired about urination only sometimes. Frequent, abnormal urination is one of the first signs of FLUTD (Lew-Kojrys et al., 2017). Therefore, enquiring about urinary habits only sometimes is interesting, as abnormal urination is likely the reason the cat is presented to the clinic. One can miss important history of the cat, as abnormal urination could have been present for days or even weeks prior. The cat could have also had separate episodes months or even years before. This information would be useful from the diagnostic point of view. It is possible that there are more free-roaming cats in Estonia. The owners would then not be able to tell if there had been any abnormalities in the urination when the cat is outside. Whether the veterinarians enquire about the cat's ability to roam free without supervision was not asked in the questionnaire. Retrospectively, this information would have been important to know, as indoor-only lifestyle can be a risk factor for FLUTD (Longstaff et al. 2017).

A significant finding was that veterinarians in specialized clinics see more FLUTD due to neurological disorders. Another significant finding was that veterinarians working in specialized clinics in Finland diagnose neurological disorders less than veterinarians working in specialized clinics in Estonia. Pelvic trauma is a common cause for urinary tract damage but clinical signs can be vague and it can take some time to become apparent. The clinical signs are similar to other FLUTD conditions including hematuria and dysuria. Depending on the neurological injury cats can have a bladder that is difficult to express or bladder that is soft and easy to express (Meeson & Corr, 2011). Depending on the cause behind the neurological disorder, which is often due to trauma (eg. hit by or run over by a car), the prognosis varies. For example, with sacrocaudal injury, the consequence is traction on the cauda equina which can cause deficits in bladder sphincter function. Careful neurological assessment is always critical. Tatton et al. (2009) reported that cats who had intact tail base sensation within 48 hours of the trauma, gained control of urination quickly,

in 1-9 days. However, absent tail base pain sensation did not exclude recovery and approximately 60% of cats recovered with return of control of urination in 2-6 days. With sacrococcygeal injuries, the prognosis is good for the return of normal urinary function if the cat has anal tone and perineal sensation at the initial presentation. If normal urination returns, it usually happens within 2-30 days (Smeak & Olmstead, 1985). It is possible that the veterinarians working in specialized clinic have more experience of neurological conditions. Some of the veterinarians were also working in a university hospitals and it is likely that a hospital sees a lot more emergency patients due to trauma, or other sudden neurological conditions.

In Estonia, antimicrobials were prescribed more often than in Finland and 5.9% prescribed antibiotics prophylactically. Because of the small sample size, this finding cannot be extrapolated to all of the veterinarians in Estonia but is an interesting finding. Antimicrobial resistance is a global issue that is a threat to not only animal health, but to human health as well (Middlemiss, 2018). *E. coli* is the most frequently isolated bacteria from cats and dogs causing UTI (Marques et al., 2016). In cats, approximately 40-70% of positive cultures are *E. coli* (Teichmann-Knorrn et al., 2018). A recent study by Joosten et al. (2020) reported *E. coli* resistance to at least one antimicrobial agent in 27% of the isolates from Belgium, Italy and the Netherlands. Schmitt et al. (2019) reported that in Switzerland in less than 40% of suspected FLUTD cases bacterial culturing and susceptibility testing was carried out. They also reported that in case of FLUTD, up to 34% of cases were prescribed antibiotics although antibiotics were not indicated. Nykäsenoja et al. (2019) reported feline *E. coli* isolates to be more susceptible to antimicrobial than the canine ones but were more resistant in 2018 than in the previous years in Finland. Antimicrobial non-susceptibility of feline *E. coli* for ampicillin in 2018 was approximately 35% and to amoxicillin/clavulanic acid a little over 10%. These numbers were higher than in the previous year. European Medicines Agency's (EMA) European Surveillance of Veterinary Antimicrobial Consumption (ESCAV) report from 2020 concluded that over 6500 tonnes of antimicrobials were sold for veterinary use in 2018. The amounts sold in tablets (from overall sales) were 10.3% in Finland and 2.3% in Estonia. As tablets are mainly used for companion animals, this gives an idea of the amount used in small animals. In Finland, overall sales of antimicrobials were markedly decreased by 18% from 2010 to 2018. In Estonia, there was a 31% decrease in antimicrobials sold from 2014 to 2018.

De Briyne et al. (2013) surveyed veterinarians from 25 European countries. The most important factors for selection of antibiotics and whether to use antimicrobials included sensitivity testing results, the veterinarian's own experience, ease of administering the medication and the risk for antimicrobial resistance developing. Less important factors were owner demands, culture and profits. There was no marked difference between different practitioners. Vanderweerd et al. (2012) reported similar findings, where the decisions on antimicrobial prescriptions were based on consulting a collegue and Internet sources rather than using evidence-based approach such as peer-reviewed literature and scientific databases, mostly due to limited time.

Due to the small sample size from Estonia, the findings of this study most likely do not represent most of Estonian veterinarians and their antimicrobial prescriptions. The number of respondents from Finland was over three times bigger and most likely reflects the country's veterinarians more accurately. It is possible that the veterinarians who replied to the Estonian questionnaire are of older or younger generation, live in an area that is possibly more remote or have more demanding customers. It is also possible that fewer respondents from Estonia work for example in a hospital with the possibility for bacterial culturing and more advanced diagnostics. Urine sediment analysis and bacterial culturing are more commonly done in university hospitals (Schmitt et al., 2019). Antimicrobial resistance is a global threat and all measures possible should be taken to decrease the antimicrobial use in small animals. Veterinarians have very limited time but continuing professional development and training with focus on antimicrobials is likely to be effective to influence the prescribing behaviours of veterinarians (De Briyne et al., 2013).

NSAIDs were prescribed commonly. One of the main corner stones of FLUTD management is analgesia. Kullmann et al. (2018) recently reported an increased expression of cyclooxygenase (COX)-1 and COX-2 in the urinary bladder and urethra of cats with FIC. This emphasized the possible potential benefits of anti-inflammatory medications. Opioids are also used as a part of treatment protocol in both countries. Opioids, such as buprenorphine seem to be beneficial in short-term pain relief of FLUTD cats (Hostutler et al., 2005). Taking into consideration the pain associated with different FLUTD conditions, pain management should always be taken into consideration first hand.

A prescription diet was always recommended in Estonia, whereas only half of the veterinarians in Finland recommended a diet. FIC and uroliths are one of the most common

causes for FLUTD (Eggertsdóttir et al., 2021) and there is evidence on some diets working for these conditions, which could explain the high percentage that veterinarians in Estonia recommended a diet. American College of Veterinary Internal Medicine (ACVIM) consensus on the treatment of struvite uroliths and moderately radiopaque uroliths in cats with approximately neutral urine pH is dietary dissolution. ACVIM has also stated, that most struvite uroliths can be safely dissolved with minimal risk (Lulich et al., 2016). Just recently, Tefft et al. (2021) reported a successful dissolution of suspected struvite uroliths in 28 days or less and maintained remission of urolith induced LUTS in cats fed a test diet. Therefore, recommending a diet is reasonable as it is not invasive and the dissolution diets have been proven effective. There are diets aimed for the treatment of FIC as well. Kruger et al. (2015) reported that targeted nutritional intervention (feeding a prevention food) can significantly reduce the incidence rate of recurrent episodes of non-obstructive FIC. Similar findings were reported by Naarden & Corbee (2020) with cats that were fed a therapeutic diet. Recurrence rate was significantly lower in those cats than the cats that were fed other commercial diets. Longstaff et al. (2017) reported an interesting finding in their study, where cats whose diet was changed between 12 to 18 months had an increased risk for LUTS at 18 months of age.

Urine acidifying supplements were recommended more commonly in Estonia. Cranberries have been used in the prevention of UTI's for years. The mechanisms has not been completely clarified, but it is suggested that the A type proanthocyanidins (PAC) that cranberries contain, can inhibit the adherence of *E. coli* to uroepithelial cells (Raditic, 2015). It has been reported that cranberry extract supplementation has an inhibitory effect on uropathogenic *E. coli* adherence in cats and dogs urinary epithelial cells, but this has been observed in *in vitro* studies (Mayot et al., 2018). Olby et al. (2017) found no benefit of oral cranberry extract in dogs with spinal cord injury developing bacteriuria but a possible association between lower risk of *E. coli* bacteriuria and urine antiadhesion activity was discovered.

Jepson et al. (2012) conducted a meta-analysis where different studies looked at susceptible people consuming cranberry products for the prevention and treatment of UTI. The main finding of the study was that, compared with placebo, water or no treatment, cranberry products did not reduce the occurrence of symptomatic UTI, except in young women with recurrent UTI's. Nururrozi et al. (2019) researched on supplement of cats with ammonium chroride and ascorbic acid for the prevention of struvite urolith formation and their study

showed that in 89% of cats the urine pH was lowered and struvite crystal density was reduced. Natural medications, such as cranberry juice and pomegranate, for the prevention and treatment of urinary tract disoders are quite commonly recommended and sold for the human consumers. This could be one of the reasons why they are recommended to animals as well. Cranberry supplements are unlikely to do any harm. They might not be palatable for some of the animals and trying to feed them could be a source of stress for cats. Cranberry supplements are not necessarily the most affordable option so recommending them should be done with caution, as currently there are no valid studies on the efficacy, route and correct dosage of these supplements for the animals.

GAG layer supplements were recommended quite commonly in both coutries. Changes in the GAG layer have been in reported in humans with IC as well as in cats with FIC (Gunn-Moore & Shenoy, 2004; Buffington, 2011a). Also, lower urinary GAG-to-creatinine concentration has been reported in cats with FIC (Panchaphanpong et al., 2011). There are varying results of the GAG supplementation with FIC cats. Gunn-Moore & Shenoy (2004) reported no clinical significance with oral GAG supplementation. A study conducted by Panchaphanpong et al. (2011) looked at plasma GAG concentration of cats receiving NAG supplement daily. They found significantly increased plasma GAG concentration after 21 days of treatment. Bradley & Lappin (2014) researched intravesical administration of GAG product in cats with UO and found that cats that received the GAG product showed no repeated UO during the follow up period, compared to the placebo-treated group of cats who did develop repeated obstructions. Intravesical administration of GAGs also seems to be beneficial in humans with IC (Forrester & Towell, 2015). The intravesical administration of GAG product (A-CYST, Dechra Veterinary Products) could be a promising product for cats suffering from recurrent UO but at least at the moment it is not available in Finnish market and most likely more studies on the effect of the product are needed. Currently the efficacy of oral GAG supplementation in cats remains unproven (Sharp, 2020).

Increase in water intake was recommended by almost all of the veterinarians. In theory, diluting the urine via additional water intake could dilute urea and potassium chloride, which could be benefial for cats with FIC. Also increase in dietary sodium has been proposed as way of diluting urine (Forrester & Towell, 2015). Cats with urolithiasis do benefit from modification of water supply and the recurrence rate is lower these cats (Kaul et al., 2020). Adding flavoring to tap water can also positively influence total water intake in cats and this

can lead to increased urine output (Zanghi et al., 2018). Encouraging increased intake of water is a relatively easy and inexpensive option to try out and is not going to do any harm.

In treatment of FIC, NSAIDs were more commonly prescribed than opioids. Taking into consideration the recent findings by Kullman et al. (2018) where increased expression of COX-1 and COX-2 in the urinary bladder and urethra of cats with FIC was found, NSAIDs should be considered especially with FIC cats, with the exception of cats with suspicion of kidney disease. Opioids were not as commonly prescribed. This could be due to the fact, that the only prescription opioid possibility is tramadol, which can have multiple side effects such as nausea and vomiting. Individual cats can react to tramadol differently so the owner could try the medication as it might be beneficial for an individual cat.

Antidepressants were not commonly prescribed. If they were prescribed it was often because sort of a last resort option for more challenging FIC cases. Chew et al. (1998) reported success with 12 months amitriptyline administration in severe recurrent IC, with side effects such as decreased grooming, transient cystic calculi and weight gain. Kraijer et al. (2003) reported no effectiveness of 7-day course of amitriptyline administration for idiopathic FLUTD. Kruger et al. (2003) reported that clinical signs of FLUTD recurred faster and more frequently in the cats treated with amitriptyline. Currently, the efficacy of amitriptyline in treatment of FIC is not proven. It was not commonly prescribed, and if it was, it was the last resort trial therapy if mostly everything else had been tried, or if the owner was not able to modify the cat's environment. Chew et al. (1998) reported some success with amitriptyline administration but only after 12 months of treatment. This time frame for many owners is unlikely to be acceptable. Also, the side effects, such as sedation, weight gain and urine retention most likely outweigh the possible benefits.

Anxiety relieving supplements were recommended more often in Finland than in Estonia. Anxiety relieving supplements were also recommended more often by the veterinarians working in specialized clinics in Finland than in Estonia. Anxiety relieving supplements can contain for example alpha-casozepine and tryptophan. Alpha-casozepine is a protein in cow's milk that has an affinity for gamma-aminobutyric acid (GABA) receptors in the brain and similar effects to benzodiazepines have been reported. Tryptophan is an essential amino acid and is the precursor for melatonin and serotonin, which have been linked with regulation of many behavioral processes (Landsberg et al., 2017). Beata et al. (2007) reported efficacy with alpha-casozepine in management of cats that were showing anxiety in stressful

conditions. The cats showed improvement in their fearful behaviors and sought contact with familiar and unfamiliar people. Landsberg et al. (2017) reported that a therapeutic diet supplemented with alpha-casozepine and L-tryptophan, has an anxiolytic effect when the cat is placed in an unfamiliar location, however, this effect seemed to work for moderately anxiety-provoking situations. The diet was supplemented with both alpha-casozepine and L-tryptophan so it is unclear whether anxiolytic effect was due to either one of the supplements or their effect together. Some of the veterinarians both in Finland and Estonia recommended a diet supplemented with anxiolytic supplements in case of FIC. As there is some evidence on the effect of these supplements, and again they are unlikely to make the cat's condition any worse, they could be recommended as a part of multimodal therapy.

Facial pheromones were quite commonly recommended in both countries. The pheromone has been isolated from facial secretions of cats. The pheromone can be deposited to familiar object to manage territory, to stabilize the cat and promote exploratory behavior and food intake. Artificially synthesized feline facial pheromone has been shown to reduce long term urine spraying, reduce signs of FIC and encourage cats to settle (Gunn-Moore & Cameron, 2004; Pereira et al., 2016). As stress is a big part of FIC and as the pheromone decreases the stress the cat is experiencing, the pheromone diffusers could therefore be recommended.

In this study, statistically significant association was found in the treatment recommendation of acupuncture. Veterinarians working in a specilized clinics recommended acupuncture approximately four times more often than veterinarians working in non-specialized clinics. Acupuncture has a long history and successful use has been reported in both human and veterinary medicine. Some reports on success with veterinary context go back to 3000 years or more (Johnson, 2018). Acupuncture is used in today's modern veterinary medicine for acute and chronic painful conditions. It has been well accepted, because it is minimally invasive and there is a minimal risk for adverse effects. Acupuncture can be used as a part of multimodal therapy approach (Fry et al., 2014). American Animal Hospital Association (AAHA) states that acupuncture is a safe and compelling method for pain management and should strongly be consider as a part of multimodal pain treatment (Epstein et al., 2015). Research of acupuncture in the treatment of FIC is scarce but there are studies done of acupuncture treatment in humans with IC, which is very similar to FIC. O´Hare et al. (2013) conducted a survey study with people with IC and reported that 56.9% of patients improved with the acupuncture treatment. It has also been reported that in cystitis prone women treated with acupuncture have one-third the rate of cystitis compared to untreated women (Al-Badr

& Al-Shaikh, 2013). It is possible that acupuncture is seen as a non-Western way of medicating an individual and is not therefore commonly recommended in Finland and Estonia. Also the lack of studies done on animals with different acupuncture treatments can influence the recommendation frequency of this treatment. However, acupuncture is unlike to do any harm when done by a certified veterinary acupuncturist so it is something that could be suggested to the owners of FLUTD cats.

Cats have generally been considered easy companion animals. They also live in close contact with their owner but there is not much science on how cats relate to their surroundings, where most behavioral problems stem from (Bradshaw, 2018). MEMO can help to resolve some of the problem behaviors (such as house soiling).

Most commonly recommended MEMO was the addition of more litter boxes. Urination patterns in cats are very important and providing more litter boxes than there are cats, may reduce the abnormal elimination behaviors that can lead to FLUTD (Piyarungsri et al., 2020). A standard rule has been, that there should be as many resources as there are cats, plus one additional one. Litter boxes that are covered, do not contain enough litter or have litter type that the cat finds aversive can also lead to unwanted urination behavior (Forrester & Towell, 2015). A study by Grigg et al. (2013) found that, if the litter boxes are sufficiently kept clean, cats in general do not seem to show preference for a certain type of litter box. However, there are personal preferences to a litter box type, so a "cafeteria" of litter box types should be available to each individual cat. This emphasizes the need for trials of different kind of litter and litter boxes for individual cats.

Another commonly recommended MEMO addition was offering multiple drinking locations. Cats are known to be poor with drinking so any encouragement to increase the water intake is recommended. As previously stated, there should multiple same resources and this could apply to the water sources as well. Robbins et al. (2019) reported that adult cats do not show a preference to certain types of water bowls. Again, some of the cats in the study did show personal preference, so the addition of different kind of cups, bowls and water fountains should be recommended to the owners to encourage increased water consumption.

A quiet area dedicated only for the cat was also commonly recommended. For cats, a safe and private place is often in raised location as this gives the cat a sense of seclusion and

isolation. There should be at least as many safe places to comfortably fit a cat, as there are cats. Quality of space is also more important than the amount of space. The cat's environment should include vertical structures for climbing, resting places at ground level as well as higher up, and areas for hiding and scrathing surfaces should be provided (Jongman, 2007; Ellis et al., 2013). There are multiple ways that the owner can increase the cat's vertical space. Vantage points high-up, especially for cats that easily startled or stressed, should be recommended to the owners as this can reduce stress and FLUTD symptoms associated with it.

Mental stimulation was also recommended. Providing mental stimulation such as toys is important as they can encourage natural behavior and owner interaction (Jongman, 2007). Cats need an outlet for hunting. Hunting is also play behavior (Rodan et al., 2011). Interestingly, cats that are offered a high meat protein diet with daily 5-10 minute object play brought back captured prey less frequently (Cecchetti et al., 2021). Cats have been considered an asocial species but are infact social. Their social need do differ from dogs, so it might be difficult for owners to recognize the patterns of how cats display social behaviors. Cats form social bonds and can become distressed when attachment figure is absent (Stepita, 2015). Therefore, more time with the owner, in form of play or other activities, could reduce the possible stress the cat is experiencing.

MEMO is an important addition to any cat's life but especially to FLUTD cats, as a big cause for the syndrome is stress. MEMO is quite easily implemented in each individual's life and not all the MEMO recommendations have to be tried simultaneuously. Owners often lack understanding of normal feline behavior and that can have a negative impact on the cat's welfare (Bradshaw, 2018). Therefore, adding and implementing MEMO will offer the cat a more species-specific environment and contribute to a more stress-free environment for the cat.

5.1. Limitations of the study

There are several limitations to the study. Firstly, questionnaires in general are not easy to conduct and require careful planning, effort and time. The questionnaire has to be planned so that there are only questions that are relevant to the subject as having too many or irrelevant questions reduces the response rate (Jones et al., 2013).

The questionnaire was formed in English and then translated to Finnish and Estonian. The Finnish translation was done by the conductor of the study, myself, and therefore it is possible that the grammatical correctness, and how the questions are formed in Finnish could have an affect to the results. Questions for the Estonian questionnaire were also checked by the Language center of the university, and are therefore more professionally translated. This is an aspect that can affect the results as well.

The questionnaires were distributed via Evidensia email list (Finland) and veterinarian's Facebook-groups (Finland and Estonia). The differences between the distribution channels of the questionnaire could have affected the results. It is possible that a questionnaire sent via email is considered more professional, especially if it is sent through a company email. The completion rate in Estonia was considerably lower than in Finland and the distribution channel of the questionnaire could have affected that.

It is very possible that this kind of distribution option exluded many veterinarians who either are not on social media or did not receive the link to the questionnaire. Evidensia clinics are also a large chain, with the latest diagnostic options available for the veterinarians. Diagnostics options in different clinics are not necessarily similar and that will also affect diagnostic possibilities and outcome of different FLUTD conditions. It is also possible that the questionnaire was more frequently answered by veterinarians who are maybe more interested in feline medicine or regularly see more feline patients with FLUTD. This can affect the results, because perhaps FLUTD is more commonly and extensively known if there´s personal interest in this complex syndrome.

The questionnaire was relatively long with 58 questions altogether. It´s possible, that some of the respondents who started the questionnaire, decided to drop out due to the length of the questionnaire. It is also possible that the questions in the beginning of the questionnaire were more thoroughly thought of and answered than the ones at the end of the questionnaire.

One responded commented that it was difficult to navigate the questionnaire platform and this could have affected other's replies as well. Another respondent commented, that the questionnaire was aimed more at small animal practice veterinarians than it was to municipal veterinarians, so that as well could have affected the results. Few respondents also pointed out, that in some of the questions should have had an "not known" answer possibility, as they were forced to choose between two options (eg. male vs. female) although they were

not completely sure.

The sample size of the study was also quite small. The sample size was also different between Finland and Estonia and this can affect the results of study. It is possible, that the results would have been different if the respondent numbers were more equal. One thing that could have also affected the results of the study was the scope of the questions. It´s possible that not nearly all aspects of FLUTD were covered or the right questions were not asked, or asked in a understandable matter and this might affect the results.

CONCLUSIONS

FLUTD is a term that emcompasses many different conditions that affect lower urinary tract of cats. These conditions include FIC, UTI, urolithiasis and different disorders affecting micturition. Risk factors for FLUTD are many including the cat's age, lifestyle, access to outdoors and feeding. Most common clinical signs include periuria, pollakiuria, stranguria and hematuria.

FLUTD conditions most often occur with the bladder and urethra but also ureters can be affected. Bladder is believed to be one of the organs affected by a systemic process due to sensitized nervous system. Etiologies of FLUTD are variable. There is not one unifying etiology behind FLUTD but current research does suggest that several of the conditions might be partly due to stress and stressful events in the cat's life. The etiologies differ also depending on the cat's age and environment and therefore no assumption of the reason behind the clinical signs the cat is displaying can be made without thorough examination.

Diagnostics for FLUTD are relatively non-invasive and easy to perform. Diagnostic tools are critical in determining the underlying cause and deciding on possible treatment. Treatments and outcomes vary depending on the etiology, owner willingness and patient's response to treatment. Some treatments can be curative, while others are mainly palliative. Some of the FLUTD conditions reoccur rather easily (eg. FIC without correct implementation of MEMO) so it´s important that owner's are aware of the possible treatments and outcomes for the diseases.

The were few main findings of this study. Antibiotics were prescribed more often in Estonia. Urine acidifying supplements and GAG supplements were also commonly recommended in Estonia. Veterinarians working in specialized clinics diagnosed more neurological disorders and recommended acupuncture in the treatment of FIC more than veterinarian working in non-specialized clinics. There were also differences between the veterinarians working in Finland and Estonia. Neurological disorders were diagnosed less in Finland but anxiety relieving supplements were recommended more often. The results of this study are

interesting as they highlight some differences in the diagnoses and treatments of FLUTD between veterinarians in Finland and Estonia. However, more thorough studies are needed to confirm actual differences.

AKNOWLEDGEMENTS

I would like to express my sincere thank you to Kristel Peetsalu for her invaluable help, comments and guidance with my thesis. I am also very grateful to professor Toomas Orro for his feedback, patience and help, especially with the statistical analysis. Thank you to the academic staff at the Language Center (Keelekeskus) for the corrections to the language of the Estonian questionnaire and introductory text.

I would like to thank the veterinarians in Finland and Estonia, who gave me valuable feedback on the preliminary questionnaire. I would like to thank all the veterinarians in Finland and Estonia who took part in the study by completing the questionnaire.

I would also like to thank my family and friends for their understading, patience and unwavering support throughout my studies. Last, but not least, I would like to thank all the wonderful animals in my life for their spirit and presence. This is all for you.

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APPENDIXES

Appendix 1. Finnish introductory text and questionnaire

Saatekirje tutkimukseen
osallistuvalle
Tampereella 07/2020

Hyvä vastaanottaja,
Olen viimeisen vuoden eläinlääketieteen opiskelija Viron maatalousyliopiston eläinlääketieteellisestä tiedekunnasta. Kirjoitan tutkintooni kuuluvaa opinnäytetyötä kissojen alempien virtsateiden sairauksista (työotsikolla Approach to feline lower urinary tract disease (FLUTD)). Tutkimukseni pääasiasiallisena tavoitteena on vertailla, miten eläinlääkärit lähestyvät kyseistä syndroomaa Suomessa ja Virossa ja mitä keskeisiä eroja on mahdollisesti havaittavissa maiden välillä.

Tutkimukseen osallistuminen on vapaaehtoista. Osallistuessasi sinulle jaetaan kyselylomake koskien FLUDT-sairauksien diagnostiikkaa ja hoitoa. Vastaaminen vie noin 10-15 minuuttia. Antamasi tiedot käsitellään luottamuksellisesti ja tutkimukseen osallistujien anonymiteetti turvataan. Tutkimuksen valmistuttua kerätty data myös tuhotaan asianmukaisesti.

Vastaan mielelläni mahdollisiin tarkentaviin kysymyksiin tutkimukseeni liittyen.

Osallistumisesta ja yhteistyöstä kiittäen,
Mervi Sulin
mervi.sulin@student.emu.ee

HISTORIA

1. Kerro omin sanoin, mitä käsität termillä FLUTD?
2. Minkä/mitkä seuraavista FLUTD- sairauksista olet kohdannut klinikallasi (voit valita useamman vaihtoehdon)?
    a. Kissan idiopaattinen kystiitti
    b. Urolitiaasi
    c. Virtsatietukos
    d. Virtsatieinfektio
    e. Neoplasia
    f. Synnynnäiset anatomiset viat
    g. Trauma
    h. Neurologinen sairaus
    i. Käytöshäiriöt

3. Mitä diagnostisia menetelmiä yleensä käytät eri FLUTD-sairauksien diagnosoinnissa (esim. virtsan analysointi, verikoe)?
4. Mitkä ovat FLUTDin yleisimmät kliiniset oireet (omistajan kertoman mukaan)?
    a. Hiekkalaatikon ulkopuolelle virtsaaminen
    b. Lisääntynyt virtsaaminen
    c. Kivulias virtsaaminen
    d. Kissa yrittää virtsata normaalia useammin
    e. Anuria
    f. Verta virtsassa
    g. Genitaalialueen nuoleminen
    h. Letargia
    i. Oksentaminen
    j. Jotain muuta, tarkennathan?
5. Mitkä ovat yleisimmät FLUTDin kliiniset oireet, jotka ovat nähtävissä klinikalla (esim. iso/laajentunut virtsarakko, kivulias vatsaontelon palpaatio)?
6. Ovatko FLUTD-kissat klinikallasi yleensä…?
    a. Alle 10-vuotiaita
    b. Yli 10-vuotiaita
7. Ovatko FLUTD-kissat klinikallasi yleensä…?
    a. Naaraita
    b. Uroksia
8. Ovatko urospuoliset FLUTD-kissat klinikallasi yleensä…?
    a. Kastroituja
    b. Kastroimattomia
9. Ovatko naaraspuoliset FLUTD-kissat klinikallasi yleensä…?
    a. Steriloituja
    b. Steriloimattomia
10. Kuinka kauan keskimäärin FLUTD-kissoilla on ollut kliinisiä oireita ennen klinikalle tuloa (omistajan kertoman mukaan)?
    a. Vähemmän kuin viikon verran
    b. Kauemmin kuin viikon verran
11. Ovatko FLUTD-kissat yleensä
    a. Alipainoisia
    b. Normaalipainoisia
    c. Ylipainoisia
12. Onko kissoilla yleensä FLUTD, joka on toistuvaa/uusinut?
    a. Kyllä
    b. Ei
    c. Ei tiedossa
13. Suoritatko yleensä vatsaontelon palpoinnin?
    a. Kyllä
    b. Ei
    c. Joskus
14. Mittaatko yleensä lämpötilan?

a. Kyllä
b. Ei
c. Joskus

15. Tiedusteletko omistajalta yleensä kissan ruokavaliosta anamneesia ottaessasi?
    a. Kyllä
    b. Ei
    c. Joskus
16. Tiedusteletko omistajalta yleensä kissan virtsaamisesta anamneesia ottaessasi?
    a. Kyllä
    b. Ei
    c. Joskua

DIAGNOSTIIKKA

1. Mitataanko virtsan ominaispaino (USG) yleensä?
    a. Kyllä
    b. Ei
    c. Joskus
2. Analysoidaanko virtsa yleensä virtsatestiliuskan avulla?
    a. Kyllä
    b. Ei
    c. Joskus
3. Analysoidaanko yleensä virtsan sedimentti?
    a. Kyllä
    b. Ei
    c. Joskus
4. Viljelläänkö virtsa yleensä?
    a. Kyllä
    b. Ei
    c. Joskus
5. Milloin virtsa yleensä viljellään?
    a. Jos kissalla on verivirtsaisuutta
    b. Jos kissalla on bakteereja virtsassa
    c. Jos kissalla on proteiinia virtsassa
    d. Jos kissalla on leukosytoosi
    e. Jossain muussa tapauksessa, tarkennathan?
6. Kerätäänkö yleensä vapaasti laskettua virtsaa?
    a. Kyllä
    b. Ei
    c. Joskus
7. Kerätäänkö virtsaa yleensä katetroimalla?
    a. Kyllä
    b. Ei
    c. Joskus

8. Kerätäänkö virtsaa yleensä kystosenteesillä?
    a. Kyllä
    b. Ei
    c. Joskus
9. Otatko yleensä röntgenkuvia kissoista, joilla on susp. FLUTD?
    a. Kyllä
    b. Ei
    c. Joskus
10. Jos vastasit edelliseen kysymykseen kyllä tai joskus, keskimäärin kuinka usein otat röntgenkuvat?
    a. Alle 50% tapauksista
    b. Yli 50% tapauksista
11. Teetkö yleensä ultraäänitutkimuksen kissoille, joilla on susp. FLUTD?
    a. Kyllä
    b. Ei
    c. Joskus
12. Jos vastasit edelliseen kysymykseen kyllä tai joskus, kuinka usein keskimäärin teet ultraäänitutkimuksen potilaalle?
    a. Alle 50% tapauksista
    b. Yli 50% tapauksista
13. Tarkistatko yleensä hematologiset arvot muiden mahdollisten sairauksien varalta?
    a. Kyllä
    b. Ei
    c. Joskus
14. Tarkistatko yleensä elinarvot FLUTD-kissoilta (esim. kalsium, munuaisarvot)?
    a. Kyllä
    b. Ei
    c. Joskus
    d. Muu, täsmennäthän
15. Milloin yleensä tarkastat elinarvot?
    a. Kaikilta kissoilta, joilla on FLUTD
    b. Kissoilta, joilla on idiopaattinen kystiitti
    c. Kissoilta, joilla on susp. virtsatietukos
    d. Muulloin, milloin?
16. Tarkastatko tulehdusarvoa (SAA) FLUTD-kissoilta?
    a. Kyllä
    b. Ei
    c. Joskus
17. Tarkastatko elektrolyyttiarvoja FLUTD-kissoilta (esim. kalium)?
    a. Kyllä
    b. Ei
    c. Joskus
18. Jos vastasit edelliseen kysymykseen kyllä, milloin yleensä tarkastat elektrolyyttiarvot?

a. Kaikilta kissoilta, joilla on FLUTD
b. Kissoilta, joilla on idiopaattinen kystiitti
c. Kissoilta, joilla on susp. virtsatietukos
d. Muulloin, milloin?

HOITO

1. Määräätkö yleensä antibiootteja, kun kissalla on FLUTD?
    a. Kyllä
    b. Ei
    c. Joskus
2. Jos määräät antibiootteja, milloin yleensä määräät niitä?
    a. Jos kissalla on bakteereja virtsassa
    b. Jos kissalla on verivirtsaisuutta
    c. Virtsaviljelyn tuloksen jälkeen
    d. Ennaltaehkäisevästi
    e. Jonain muuna kertana, milloin?
3. Määräätkö yleensä analgeetteja kuten tulehduskipulääkkeitä, kun kissalla on FLUTD?
    a. Kyllä
    b. Ei
    c. Joskus
4. Määräätkö yleensä analgeetteja kuten opiaatteja kun kissalla on FLUTD?
    a. Kyllä
    b. Ei
    c. Joskus
5. Suositteletko yleensä virtsateiden hyvinvointiin erikoisruokavaliota (kuten liuottavaa ruokaa)?
    a. Kyllä
    b. Ei
    c. Joskus
6. Jos vastasit edelliseen kysymykseen kyllä, milloin ja minkälaisia erikoisruokia suosittelet?
7. Suositteletko yleensä ravintolisiä virtsan väkevöittämiseen?
    a. Kyllä
    b. Ei
    c. Joskus
8. Suositteletko yleensä ravintolisiä, jotka ylläpitävät virtsarakon limakalvon terveyttä?
    a. Kyllä
    b. Ei
    c. Joskus
9. Suositteletko yleensä omistajille kissan juoman vesimäärän lisäämistä (esim. useampi juomapaikka, suihkulähde)?
    a. Kyllä

b. Ei
c. Joskus

KLINIKKA

1. Onko klinikka jossa työskentelet erikoisklinikka (erikoistunut esimerkiksi kissoihin)?
    a. Ei
    b. Kyllä, tarkennathan

KISSAN IDIOPAATTINEN KYSTIITTI

1. Kerro omin sanoin, mitä käsität termillä FIC?
2. Miten yleensä diagnosoit FICin?
3. Onko kissoilla yleensä FIC, joka on toistuvaa/uusinut?
    a. Kyllä
    b. Ei
    c. Ei tiedossa
4. Tiedusteletko omistajalta yleensä muutoksista kissan elämässä (muutto, uusi lemmikki) anamneesia ottaessasi?
    a. Kyllä
    b. Ei
    c. Joskus
5. Määräätkö yleensä analgeetteja kuten tulehduskipulääkkeitä, kun kissalla on FIC?
    a. Kyllä
    b. Ei
    c. Joskus
6. Määräätkö yleensä analgeetteja kuten opiaatteja kun kissalla on FIC?
    a. Kyllä
    b. Ei
    c. Joskus
7. Määräätkö yleensä antidepressantteja kuten amitriptyliiniä, kun kissalla on FIC?
    a. Kyllä
    b. Ei
    c. Joskus
8. Jos vastasit edelliseen kysymykseen kyllä, missä tapauksessa määräät antidepressantteja?
    a. Kissoille, joilla on ensimmäinen diagnosoitu FIC
    b. Kissoille, joilla on toistuva FIC
    c. Muulloin, milloin?
9. Suositteletko yleensä ravintolisiä, jotka auttavat lieventämään kissan kokemaa rauhattomuutta ja turvattomuutta (esim. tuotteita, jotka sisältävät alfa-kasotsepiiniä)?
    a. Kyllä
    b. Ei
    c. Joskus

10. Suositteletko yleensä tuotteita, jotka sisältävät kissan naamaferomonia?
    a. Kyllä
    b. Ei
    c. Joskus
11. Suositteletko yleensä akupunktiota?
    a. Kyllä
    b. Ei
    c. Joskus
12. Onko MEMO sinulle tuttu termi?
    a. Kyllä
    b. Ei
    c. Olen kuullut MEMOsta
13. Jos MEMO on sinulle tuttu, milloin yleensä suosittelet sitä?
    a. Kissoille, joilla on ensimmäinen FIC
    b. Kissoille, joilla on toistuva FIC
    c. Muulloin, milloin?
14. Jos MEMO on sinulle tuttu, mitä suosittelet kissan elinympäristön muokkaamiseksi?
    a. Lisää hiekkalaatikoita
    b. Erilaisia hiekkoja
    c. Korkeita tasoja kissalle
    d. Raapimapuita
    e. Suihkulähteitä/useita eri vesikuppeja
    f. Aktivointia (esim. ruokaleluja)
    g. Mahdollisuus ulkoiluun
    h. Kissavideoita (esim. videoita, joissa lintuja/hyönteisiä)
    i. Yhteisen ajan lisääminen kissan kanssa
    j. Virikkeistämislelut
    k. Rauhallinen ja hiljainen paikka, johon vain kissa pääsee
    l. Lepäämispaikkoja
    m. Jotain muuta, tarkennathan?
15. Onko vielä jotain, mitä haluaisit lisätä?

Appendix 2. Estonian introductory text and questionnaire

Tere!
Olen Eesti Maaülikooli veterinaarmeditsiini eriala üliõpilane ja teen lõputööd "Kasside alumiste kuseteede haiguste (FLUTD) käsitlus". Uuringu eesmärk on võrrelda, kuidas veterinaarid Eestis ja Soomes seda sündroomi käsitlevad.

Kutsun teid uuringus osalema ja täitma küsimustikku FLUTD kohta (võtab umbes 10–15 minutit aega). Küsimustikule vastamine on vabatahtlik. Samuti on küsimustikule vastamine anonüümne – küsimustikule vastanute nimesid ei avaldata lõputöös ega kaitsmisel. Samuti ei ole võimalik identifitseerida küsimustikule vastajaid ning esitatud vastuseid. Uuringu lõpus kustutatakse kõik kogutud andmed nõuetele vastavalt.

Kui teil on mistahes küsimusi selle uuringu kohta, lahkesti kirjutage mulle e-mailile mervi.sulin@student.emu.ee või helistage numbril +358407766287. Kui teil on küsimusi oma õiguste kohta uuringus osalejana või kui teil on muresid seoses selle uuringuga, siis palun kirjutage minu juhendajale dr Kristel Peetsalule e-mailile kristel.peetsalu@emu.ee

Küsimustikule vastamisega annate oma nõusoleku uuringus osalemiseks.

Aitäh lugemast!

Ette tänades
Mervi Sulin
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KÜSIMUSTIK

Kasside alumiste kuseteede haigus

1. **Anamnees, kliiniline ülevaatus, kliinilised tunnused**

1. Palun kirjeldage oma sõnadega, mis on kasside alumiste kuseteede haigus (küsimustikus edaspidi: FLUTD, feline lower urinary tract disease).
2. Milliseid haiguse variante olete diagnoosinud oma praksises?
    a. Kasside idiopaatiline tsüstiit
    b. Urolitiaas
    c. Kusiti obstruktsioon
    d. Kuseteede bakteriaalne põletik
    e. Neoplaasia
    f. Kaasasündinud anatoomilised defektid
    g. Trauma

h. Neuroloogilised häired
i. Käitumuslikud häired

3. Palun täpsustage, milliseid diagnostilisi meetodeid te tavapäraselt kasutate kasside alumiste kuseteede probleemide diagnoosimisel.
4. Milliseid kliinilisi tunnuseid kirjeldavad omanikud kõige sagedamini?
    a. Liivakastist välja urineerimine
    b. Sagenenud urineerimine
    c. Valulik urineerimine
    d. Valulik, sage ja väikeste koguste kaupa urineerimine
    e. Uriinierituse puudumine
    f. Vere esinemine uriinis
    g. Tihe genitaalpiirkonna lakkumine
    h. Letargia
    i. Oksendamine
    j. Muud tunnused. Palun täpsustage.
5. Millised kliinilised tunnused on kliinilisel läbivaatusel kõige sagedasemad (ületäitunud kusepõis, valulik kõhu palpatsioon jne)?
6. Kliinikusse toodud FLUTD sümptomitega kassid on enamasti
    a. alla 10 aasta vanused
    b. üle 10 aasta vanused
7. Kliinikusse toodud FLUTD sümptomitega kassid on enamasti
    a. emased
    b. isased
8. Kliinikusse toodud isased FLUTD sümptomitega kassid on enamasti
    a. kastreeritud
    b. kastreerimata
9. Kliinikusse toodud emased FLUTD sümptomitega kassid on enamasti
    a. steriliseeritud
    b. steriliseerimata
10. Kui kaua kestavad omaniku kirjelduse järgi FLUTD kliinilised sümptomid keskmiselt enne, kui pöördutakse kliinikusse?
    a. Alla 1 nädala
    b. Üle 1 nädala
11. FLUTD diagnoosiga kassid on enamasti
    a. alakaalus
    b. normaalses kehakaalus
    c. ülekaalus
12. Kas korduv FLUTD on kassidel tavapärane?
    a. Jah
    b. Ei
    c. Ei oska öelda
13. Kas teostate kassi kõhu palpatsiooni kliinilisel läbivaatusel?
    a. Jah
    b. Ei

c. Vastavalt näidustusele

14. Kas mõõdate kassi kehatemperatuuri kliinilisel läbivaatusel?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
15. Kas anamneesi võttes uurite omanikult kassi söötmise kohta (kuivtoit, konserv, toortoit, õueskäiva kassi puhul saakloomad)?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
16. Kas anamneesi võttes küsite omanikult kassi tavapärase urineerimise kohta (urineerimise sagedus, ebatavalistesse kohtadesse urineerimine jne)?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele

DIAGNOSTIKA

1. Kas määrate uriini erikaalu (refraktomeetri või teiste mõõtmisvahenditega)?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
2. Kas teostate uriini testriba analüüsi?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
3. Kas uurite uriini sedimenti?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
4. Kas teostate uriini bakterioloogilist uuringut?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
5. Millistel juhtudel teostate uriini bakterioloogilist uuringut?
    a. Hematuuria puhul
    b. Bakteriuuria puhul
    c. Proteinuuria puhul
    d. Leukotsütoosi puhul
    e. Muul juhul. Palun täpsustage.
6. Kas kogute vabavoolu uriiniproovi?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele

7. Kas võtate uriiniproovi kateteriseerimise teel?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
8. Kas võtate uriiniproovi tsüstotsenteesil?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
9. Kas kasutate röntgendiagnostikat FLUTD kahtluse puhul?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
10. Kui vastasite eelmisele küsimusele “jah” või “vastavalt näidustusele”: mitmel protsendil juhtudest te kasutate röntgendiagnostikat?
    a. Vähem kui 50% juhtudest
    b. Üle 50% juhtudest
11. Kas kasutate ultraheliuuringuid FLUTD juhtumite puhul?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
12. Kui vastasite eelmisele küsimusele “jah” või “Vastavalt näidustusele”: mitmel protsendil juhtudest te kasutate ultraheliuuringuid?
    a. Vähem kui 50% juhtudest
    b. Üle 50% juhtudest
13. Kas kasutate hematoloogilisi teste, et kontrollida teiste haiguste olemasolu?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
14. Kas kasutate biokeemilisi teste (nt kaltsium, uurea, kreatiniin)?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
15. Millistel juhtudel kasutate biokeemilisi teste?
    a. Kõikidel FLUTD juhtudel
    b. Kasside idiopaatilise tsüstiidi puhul
    c. Kusiti obstruktsiooni kahtluse korral
    d. Muul juhul. Palun täpsustage.
16. Kas kontrollite ägeda faasi proteiine (SAA) FLUTD puhul?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
17. Kas kontrollite elektrolüüte (nt kaaliumi)?
    a. Jah
    b. Ei

c. Vastavalt näidustusele

18. Kui vastasite eelmisele küsimusele “jah”, siis millistel juhtudel kontrollite elektrolüüte?
    a. Kõikidel FLUTD juhtudelkui vastasite
    b. Kasside idiopaatilise tsüstiidi puhul
    c. Kusiti obstruktsiooni kahtluse korral
    d. Muul juhul. Palun täpsustage.

RAVI

1. Kas kasutate FLUTD diagnoosi korral puhul antibiootikume?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
2. Kui kasutate FLUTD diagnoosi korral puhul antibiootikume, siis millistel juhtudel?
    a. Bakteriuuria korral
    b. Hematuuria korral
    c. Uriini bakterioloogia positiivse tulemuse korral
    d. Profülaktiliselt
    e. Muul juhul. Palun täpsustage.
3. Kas kasutate FLUTD puhul NSAID-e (nonsteroidal anti-inflammatory drugs, mittesteroidsed põletikuvastased ravimid MSPVR)?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
4. Kas kasutate FLUTD puhul opioide?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
5. Kas soovitate kuseteede raviks ettenähtud ravitoitusid?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
6. Kui vastasite eelmisele küsimusele “jah”: millistel juhtudel ravitoitu soovitate ja millist (nt kuivtoitu, märgtoitu, eridieete)?
7. Kas soovitate uriini hapestavaid toidulisandeid?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
8. Kas soovitate tooteid, mis aitavad säilitada ja taastada glükoosaminoglükaani kihti?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele

9. Kas soovitate kasside veetarbe suurendamist (mitu jooginõud, voolava veega jootur jm)?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele

LOOMAKLIINIK

1. Kas töötate spetsialiseerunud kliinikus (nt kassidele spetsialiseerunud kliinik)?
    a. Ei
    b. Jah. Palun täpsustage.

KASSIDE IDIOPAATILINE/INTERSTITSIAALNE TSÜSTIIT (FIC)

1. Palun kirjeldage oma sõnadega, mis on kasside idiopaatiline tsüstiit (küsimustikus edaspidi: FIC, feline idiopathic cystitis).
2. Palun kirjeldage oma sõnadega, kuidas te diagnoosite FIC-i.
3. Kas korduv FIC on kassidel tavapärane?
    a. Jah
    b. Ei tea
4. Kas anamneesi võttes küsite omanikult kassi võimalike hiljutiste elumuutuste kohta (nt uus lemmikloom peres, kolimine)?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
5. Kas kasutate FIC-i ravis NSAID-e?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
6. Kas kasutate FIC-i ravis opioide?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
7. Kas kasutate FIC-'i ravis antidepressante (nt amitriptülliin)?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
8. Kui vastasite eelmisele küsimusele "jah": millistel juhtudel kasutate FIC-i ravis antidepressante?
    a. Esmakordse FIC-i ravis
    b. Korduva FIC-i ravis
    c. Muul juhul. Palun täpsustage.
9. Kas soovitate ärevust vähendavaid toidulisandeid (nt α-casozepine´i sisaldavaid tooteid)?

a. Jah
b. Ei
c. Vastavalt näidustusele

10. Kas soovitate tooteid, mis sisaldavad kasside feromoone?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
11. Kas soovitate akupunktuuri?
    a. Jah
    b. Ei
    c. Vastavalt näidustusele
12. Kas tunnete elukeskkonna rikastamise ravivõtet (multimodal environmental modification, MEMO)?
    a. Jah
    b. Ei
    c. Olen kuulnud MEMOst
13. Kui vastasite eelmisele küsimusele „jah“: millistel juhtudel seda soovitate?
    a. Esmakordse FIC-i ravis
    b. Korduva FIC-i ravis
    c. Muul juhul. Palun täpsustage.
14. Milliseid kasside elukeskkonna rikastamise võtteid soovitate?
    a. Iga kassi kohta 1 liivakast + veel 1 liivakast
    b. Kassiliiva vahetus
    c. Kõrgemal asuv turvaline vaatluspunkt
    d. Kraapimispuu
    e. Mitu jooginõud / voolava veega jooginõu
    f. Mentaalne stimulatsioon (nt toidupusle)
    g. Õueskäimise võimalus
    h. Kassivideo (nt videod lindudega, putukatega)
    i. Rohkem omanikuga koosveetmise aega
    j. Stimuleerivad mänguasjad (nt kassi jahiinstinkti stimuleeriv mänguasi)
    k. Vaikne ala, kus kass saab olla segamatult
    l. Mitu puhkeaset
    m. Muu. Palun täpsustage.
15. Kas soovite midagi lisada?

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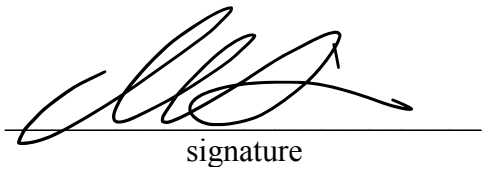
Author of the final thesis 
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